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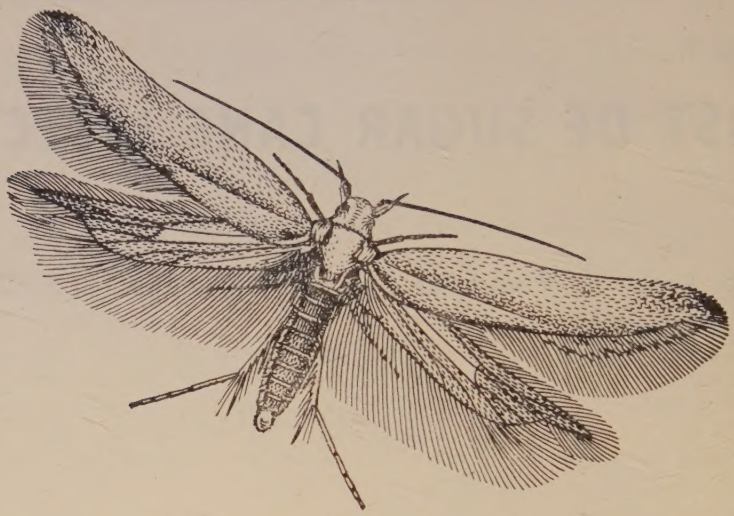

THE ANGOUMOIS GRAIN MOTH

Sitotroga cerealella

This moth is a major pest of grain and seeds, especially in warm, temperate regions. In the U.S.A. it is claimed to be second only in importance to the grain weevil.

Attack begins in the field and continues in the store, where the young larva penetrates into the grain and consumes the contents, often until only the husk remains. The adult then emerges and begins the life cycle again.

As well as causing contamination with excreta, this species can impart a most unpleasant smell to the grain, giving it an unpalatable flavour.

Distribution Maps of Insect Pests.—Series A, nos. 25–30. London, Commonw. Inst. Ent., 1953.

These maps are nos. 25–30 of a series already noticed [*R.A.E.*, A **40** 203, 369] and deal, respectively, with *Pieris brassicae* (L.), *Lymantria dispar* (L.), *Nezara viridula* (L.), *Empoasca fabae* (Harr.), *Cephus cinctus* Nort. and *C. pygmaeus* (L.).

Cohic (F.). *Araecerus vieillardi* **Montr., parasite du tabac en Nouvelle-Calédonie.**—*Rev. franç. Ent.* **17** fasc. 1 pp. 88–92, 7 figs., 2 refs. Paris, 1950.

Araecerus vieillardi (Montr.) was found causing serious damage to hands of Maryland tobacco in New Caledonia, where it was associated with much smaller numbers of *A. fasciculatus* (Deg.). The eggs are deposited on the drying leaves, usually near the central vein, and the larvae mine in the veins, and may perforate several leaves in the pile in the search for fresh ones when the first are exhausted. Leaves damaged in this way are unsuitable for cigar wrappings. Attack ceases when the leaves become dry and brittle, but is possible at the lowest humidity suitable for manufacturing purposes. The larvae, pupae and adults of *A. vieillardi* are described, and characters separating it from *A. fasciculatus* are given.

[Borkhsenius (N. S.) & Khadzhibeĭli (Z. K.).] Борхсениус (Н. С.) и Хаджибейли (З. К.). **Coccids of the Genus** *Kuwanaspis* **MacG. (Homoptera, Coccoidea), injurious to Bamboo in the Caucasus and the Crimea.** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 12–17, 6 figs., 16 refs. Moscow, 1950.

Descriptions are given of the adult female and the female and male scales of *Kuwanaspis phyllostachydis*, sp. n., which is widely distributed in Transcaucasia and the Crimea and is injurious to commercial bamboos of the genus *Phyllostachys*. It is very close to *K. pseudoleucaspis* (Kuw.), and characters differentiating the two species are described. Observations near Batum, on the Black Sea, showed that *K. phyllostachydis* had two overlapping generations a year. All stages were present in summer and autumn, but only second-instar individuals survived the winter. They became sexually mature in the first half of May, and the females oviposited for 20–50 days, laying 32–60 eggs each. These hatched in 12–14 days, the first doing so at the end of May. Males occurred in all the colonies observed, and formed 43 per cent. of the total population. In October, up to 41 per cent. of the Coccids, chiefly those in the second instar, were parasitised by the Aphelinid, *Aspidiotiphagus citrinus* (Craw). A list is given of the species of *Phyllostachys* attacked. The colonies occurred at the points of origin of the stems, and intense infestation caused shedding of the leaves, thickening of the shoots and deformation of the plants. *K. pseudoleucaspis*, which is also common in Transcaucasia and the southern Crimea, attacks ornamental bamboos of the genera *Arundinaria* and *Bambusa*, the colonies occurring on the stems beneath the leaf sheaths and causing the formation of brown spots. In cases of severe infestation the whole of the stem becomes brown and dries up. Males are unknown.

[Samoĭlovich (E. N.).] Самойлович (Е. Н.). **The Influence of Feeding on the Intensity of the Development and Propagation of the Root Phylloxera** (*Phylloxera vastatrix* **Planch.**). [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 18–25, 3 refs. Moscow, 1950.

The author records experiments in the North Caucasus showing that the development of the root form of *Phylloxera vitifoliae* (Fitch) (*vastatrix*

Planch.) was more rapid when the root bark of the vines was thin than when it was thick, and rather slower during and after the period of fruit maturation than earlier in the season. The conditions leading to the formation of winged forms are discussed, and it is concluded that it is a result of overcrowding, which becomes intense at the ripening period.

[Parfent'ev (V. Ya.).] Парфентьев (В. Я.). **The House Borer *Anobium pertinax* L. (Coleoptera, Anobiidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 31–40, 8 figs., 12 refs. Moscow, 1950.

Anobium (*Coelostethus*) *pertinax* (L.) is a major pest of timber in buildings in the Soviet Union [*cf. R.A.E.*, A **18** 188], and observations on its bionomics were carried out in and near Leningrad in 1934 with a view to recommending control measures. Examination of 130 buildings showed that the Anobiid attacked coniferous timbers in walls and attic roofs. The various types of damage found are described. Decaying or rotten wood was not infested, and new timber was not attacked until it had been in position for at least five years. Low temperatures were apparently necessary for normal development, as only timber that was exposed to winter cold was infested. Observations in attics in summer and autumn showed that development was rapid at 14–28°C. [57·2–82·4°F.] and occurred in wood with a moisture content of 11–19 per cent., but heavy infestation occurred only in parts of the timber that were wetted by rain as a result of leaky roofs, and at the external ends of beams, where condensed moisture accumulated. In a test on the attractiveness of moisture to the adults, the beetles left the half of a jar containing an unmoistened piece of wood and congregated in the half containing wood that was moistened every five days. Pairing and oviposition occurred only in the presence of the moist wood. The first adults of the year appeared in March and mass flight occurred from 1st to 20th June on warm calm evenings. The eggs were deposited singly in cracks in the timber, and each female laid about 20. Numerous larvae and pupae were found from August, pupation taking place in cells in the peripheral layers of the wood. Hibernation occurred chiefly in the larval and to a less extent in the pupal stage, the larvae penetrating more deeply into the wood for overwintering.

The measures recommended are preventive in character and include the use of timbers with a moisture content of not more than 18–20 per cent., the provision of ventilation and the prevention of leaks in attics, impregnation with a wood preservative when old timbers are re-used, and burning all structural débris and heavily infested material.

[Dobrovol'skiĭ (B. V.).] Добровольский (Б. В.). **The Grape or Pear Leafroller (*Byctiscus betulae* L.) on the Don and in North Caucasus.** [*In Russian.*]—*Ent. Obozr.*, **31** no. 1–2 pp. 41–46, 16 refs. Moscow, 1950.

Observations on the bionomics of *Byctiscus betulae* (L.) were begun in 1924 in North Caucasus and the Province of Rostov, where this weevil is widely distributed and is a common pest of pear, grape vines and certain forest trees. It has one generation a year, the adults hibernating in the pupal cells in the soil, or to a less extent under fallen leaves. They appeared on the trees at the beginning of April in the south of the area, and at the end of that month in the north, and fed on the buds and leaves, particularly those of grape vines, the feeding being most intense in May. Oviposition occurred from the end of April or the beginning of May until

mid-June, with a maximum in May. Before ovipositing, the female partly cuts a shoot bearing a cluster of leaves, which rapidly wither. It then rolls the leaves into tubes, superimposing one leaf on another if they are small, and laying one egg in each as it does so. The tubes usually consisted of 5–15 leaves on pears, but single leaves were rolled on vines. The tubes usually occurred on the middle and lower parts of the plants and on the shady side of them. Infestation was heavier on pear than on grape vine, and other fruit trees were occasionally attacked. The eggs hatched in 8–10 days, and the larvae fed for 20–30 days in the tubes. The latter fell to the ground in June, and the larvae entered the soil, where they pupated in cells close to the surface. Pupae were present from mid-July, and newly emerged adults from the beginning of August. A few of these made their way to the surface between the end of August and October and fed on leaves before hibernating.

[Danilevskiĭ (A. S.).] Данилевский (А. С.). **A new Genus and Species of a predacious Moth feeding on Mealybugs,** *Coccidiphila gerasimovi* **Danilevsky, gen.et sp.n. (Lepidoptera, Momphidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 47–53, 6 figs., 8 refs. Moscow, 1950.

The new genus *Coccidiphila* is erected for *C. gerasimovi*, sp. n., which is the type, and *Batrachedra ledereriella* (Zell.), and the adults of both species and the larvae and pupae of the new one are described. Adults and larvae of *C. gerasimovi* were found in association with *Eulecanium* (*Lecanium*) *prunastri* (Boy.) and mealybugs on the Black Sea coast of the Caucasus, and it was also reared from larvae found in a consignment of *Pseudococcus maritimus* (Ehrh.) from the same region. Observations on its bionomics showed that the larvae feed on the eggs of *P. maritimus* in the ovisacs, in which they also pupate. They do not apparently attack the larvae or the adult females. There are probably several generations a year.

[Karpova (A. I.).] Карпова (А. И.). **The Prospects of Controlling the Pea Bruchid by the Biological Method with the Aid of the Egg-parasite** *Lathromeris senex* **(Grese) (Hymenoptera, Trichogrammatidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 54–62, 7 refs. Moscow, 1950.

[Nikol'skaya (M. N.).] Никольская (М. Н.). **Sexual Dimorphism of the Wings of** *Lathromeris senex* **Grese (Hymenoptera, Trichogrammatidae).** [*In Russian.*]—*T.c.* pp. 254–256, 2 figs., 2 refs.

It is stated in the second of these papers that *Bruchoctonus senex* Greze [*cf. R.A.E.*, A **13** 545; **29** 575] was described as a new genus and species in 1923, and *Lathromeris bruchocida* Vasil'ev as a new species in 1947 [**36** 242]. Both were reared in European Russia from the eggs of *Bruchus pisorum* (L.), and the latter also from those of *B.* (*Bruchidius*) *unicolor* Ol. From a comparison of the original descriptions and of numerous specimens of both sexes reared from eggs of the two Bruchids in various parts of European Russia, *Bruchoctonus senex* is transferred to *Lathromeris* and *L. bruchocida* is made a synonym of it. Differences in the wings of the two sexes are described, and a key is given enabling *L. senex* to be distinguished from *L. scutellaris* Först. and *L. johnstoni* Wtstn.

In the first paper, the author describes observations in the Ukraine in 1946–48 on the bionomics of *L. senex*, carried out to determine its value for the control of *Bruchus pisorum* on peas [*cf.* **36** 242–243]. It was also reared from eggs of *B. unicolor*, *B. affinis* Froel., *B. lentis* Froel. and *B.*

fasciatus Ol. in the field, and developed in those of *B. obtectus* Say and *Spermophagus* (*Euspermophagus*) *sericeus* (Geoffr.) in the laboratory. It was not attacked by secondary parasites. Warm dry summers with mean temperatures of 19–24°C. [66·2–75·2°F.] in June and July were favourable to both *B. pisorum* and *L. senex*. The latter produced 4–5 generations a year, development in summer being completed in 14–16 days. Winter was passed in the larval stage in the host eggs, the proportion of larvae in diapause increasing from mid-July and reaching about 80 per cent. in the autumn. Numerous host eggs fell from the pods in the course of harvesting and threshing, and the parasites survived the winter in these. Adult emergence began at the end of May, and some eggs were laid in eggs of *B. unicolor* on sainfoin [*Onobrychis sativa*], which begins to flower then. Peas of the main crop are sown between 5th and 15th April, and produce pods from about 10th June to 20th July. Only 5–25 per cent. of the eggs of *B. pisorum* on peas of this sowing were parasitised by *L. senex*, but on late peas, which produce pods in the second half of July and in August, the percentage reached 70–85, though eggs of various Bruchids on other plants were also attacked. The effectiveness of *L. senex* against *B. pisorum* in spring is limited by the destruction of many of the hibernating larvae by autumn ploughing, its habit of parasitising other Bruchids, its short flight range, and its low fecundity, the number of eggs laid by females of the first two generations averaging only 20–25, as compared with averages of 92–126 for females of *B. pisorum* [*cf.* **16** 219].

Measures to increase control of *B. pisorum* in pea fields are discussed. Late peas sown in May were found to be less heavily infested than those of the main crop, whereas parasitism by *L. senex* on them almost doubled, and good results were given by sowing narrow strips of late peas along the edges of earlier-sown fields. When these flowered, they attracted the Bruchid from the main crop and offered favourable conditions for the development of the overwintering parasite population. The pods from these strips should be picked at the beginning of August, when ovipositing by the Bruchid begins to decrease, and either threshed on the spot and the soil left unploughed, to permit winter survival of the parasite, or dried and the parasitised eggs that fall from them kept until the following spring. In the latter case, the resulting adults should be released along the edges of the fields when the peas are setting pods, at a rate of about 6,000 per acre. In experiments, large numbers for liberation in this way were secured by collecting pods bearing parasitised eggs of various Bruchids from trap strips of late-sown leguminous crops, the eggs being kept over winter under conditions approaching those in nature.

[Kolobova (A. N.).] Колобова (А. Н.). **The Clover and Lucerne Races of the Seed Pest *Bruchophagus gibbus* Boh. (Hymenoptera, Eurytomidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 63–70, 5 figs., 9 refs. Moscow, 1950.

Bruchophagus gibbus (Boh.) is a widely distributed pest of clover and lucerne in the Soviet Union, but infests a higher proportion of seed on the latter, and observations in 1937–48 in the region of Poltava showed that two distinct races are involved.

Adults of the Eurytomid appeared earlier on clover than on lucerne in each year of the observations. When infested seeds were stored under identical conditions, adult emergence from clover was 7–10 days earlier than that from lucerne, and when they were kept at constant temperature and humidity, it was 6–7 days earlier, irrespective of the actual temperature

employed. The average life of adults from the two crops was greatest (33·5 and 31·7 days) at 19·8 and 25·2°C. [67·6 and 77·4°F.], respectively, which indicated that those from clover are the more adapted to cooler latitudes, and this is in agreement with the distribution of clover cultivation, which extends northwards from the region of Poltava. To determine whether examples from one crop would infest the other, adults from clover and lucerne were confined between 24th July and 3rd August, 1948, on potted plants of lucerne or clover that were caged before flowering began. The seeds were examined between 18th and 28th August, and it was found that the females had oviposited only in the crop on which they had developed. Biometrical measurements over a period of three years showed constant differences between material from the two crops in the ratio of the length of the abdomen to that of the thorax, in the length of the ovipositor and in the shape of the eggs.

These differences in ecology, biology and morphology are held to justify the view that two distinct races or subspecies are concerned, and since the species was described from clover, the clover race is accepted as the typical one and that from lucerne is named subsp. *medicaginis*, n. Investigations in 1948 showed that a third race of *B. gibbus* develops in the seeds of *Lotus corniculatus*, the eggs differing in shape from those of either of the other two races.

[Ruivkin (B. V.).] Рывкин (Б. В.). *Telenomus verticillatus* **Kieffer (Hymenoptera, Scelionidae)—a Parasite of the Eggs of** *Dendrolimus pini*. [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 71–76, 3 refs. Moscow, 1950.

Outbreaks of *Dendrolimus pini* (L.) occurred in 1930–40 on pine in many districts of European Russia, but ceased abruptly in 1940–41. This was due largely to the action of natural enemies and diseases, and among the former the egg parasite, *Telenomus verticillatus* Kieff., which had not previously been recorded from *D. pini*, was the most important. The only other egg parasite present was *Trichogramma pini* Meĭer. Of many thousands of eggs of *D. pini* collected in White Russia in 1939, 1·8 per cent. were parasitised by *T. pini* and 22·5 per cent. by *Telenomus*, but as the numbers of adults of *Telenomus* that emerged from single host eggs averaged 10–11 and the corresponding figure for *Trichogramma* was 33, the total numbers of adults obtained were only four times as great for *Telenomus* as for *Trichogramma*.

Observations in the south of White Russia showed that *T. verticillatus* produced three generations a year, of which the first developed in May and June, usually in hosts other than *D. pini*, and the second and third developed in *D. pini* in July and August. *D. pini* oviposited from 8th July until 10th August, and adults of *T. verticillatus* emerged from the eggs from 22nd July to 2nd September, development in July being completed in 18–20 days. Of parasitised eggs dissected on 24th August, 63·6 per cent. contained adults, 33·2 per cent. contained pupae and 3·2 per cent. contained larvae of *T. verticillatus*. The adult parasites fed on the nectar of various plants and entered hibernation in October under loose bark on stumps, usually near the root collar. Males were slightly more numerous than females. They fed again and paired in spring, but owing to the insufficient numbers or even absence of hosts at that season, many died without reproducing. Few survived until eggs of *D. pini* were available. *T. verticillatus* proved easy to rear on *D. pini* in the laboratory, and investigations were begun with a view to obtaining large numbers of adults for release against the moth. Eggs of the latter were obtained by collecting

hibernating larvae that had undergone a short exposure to cold, rearing them in a greenhouse and allowing the adults to oviposit. The eggs were then exposed to the parasite and 3–5 generations of the latter were reared before *D. pini* began to oviposit in the field. The best method of preserving the parasite was to keep the parasitised eggs on ice after adults had developed in them. The adult parasites should be released at points about 110–165 yards apart, at the rate of one female to every 14 eggs of the moth, based on population counts over the whole area. The spring population of *T. verticillatus* can also be increased by introducing the food-plants of its alternative hosts into pine stands and by setting out egg-batches of *D. pini* obtained in the laboratory. There is no danger that the latter will hatch since all will be parasitised by *T. verticillatus*.

[Moiseev (A. E.).] Моисеев (А. Е.). **New Pests of *Agropyrum*—Flies of the Genus *Dicraeus* Lw. (Diptera, Chloropidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 77–79, 2 refs. Moscow, 1950.

Seeds of *Agropyrum cristatum* and *A. desertorum*, two grasses that are the chief components of mixed pastures on the dry steppes of the Transvolga region, were found in 1945–48 to be severely damaged by the Chloropids, *Dicraeus vagans* (Mg.) (*xanthopygus* (Strobl)) and *D. pallidiventris* (Macq.), of which the latter was the more important. The larvae fed on the germ and endosperm, so that the seeds lost their viability. At various points in the Republic of the Volga Germans and in the Province of Saratov, the percentage of seeds injured in 1946 and 1947 varied from 9·3 to 45. Both species had only one generation a year, the larvae hibernating in the seeds and pupating in them in spring. The pupal stage lasted 19–20 days at 18–20°C. [64·4–68°F.], and the adults emerged at the beginning of June, *D. vagans* some 3–5 days before *D. pallidiventris*. The mass flight of both species coincided with the period of flowering and seed-setting of *Agropyrum*. Eggs were laid singly on the inside of the inner flower scales, and the larvae hatched in 4–6 days and entered the seeds. Infestation was heavier in the first year of growth than in the second or third year, and *A. desertorum* was more severely attacked than *A. cristatum*, which flowers earlier. The sources of infestation were infested seeds used in sowing, refuse from seeds in the process of cleaning, fallen seeds, and straw, which contained, respectively, 52–53, 29–30, 11 and about 6 per cent. of the hibernating larvae. In some years, the numbers of the Chloropids were considerably reduced by parasites, of which *Amblymerus* sp. was the most important. Larvae of this Pteromalid parasitised 34–43·8 per cent. of those of the two Chloropids in 1946 and 42·7–43·3 per cent. in 1947.

In experiments, dusting with DDT when most of the plants were flowering and before oviposition had begun, gave very good results, killing the adults in 5–6 hours. High mortality was also given by dusting with BHC. Mixing infested seeds with naphthalene at 0·5 per cent. by weight killed 75 per cent. of the larvae, but similar treatment with DDT or BHC proved ineffective. Other measures recommended are the sowing of fresh fields at a considerable distance from old ones; the use of infested *Agropyrum* alternately for hay and for seed, which prevents the continuous increase of the flies, harvesting seed crops early to prevent the falling of the seeds, removing the straw from the fields, and cutting wild *Agropyrum* near cultivated fields before it begins to flower.

[Rodendorf (B. B.).] Родендорф (Б. Б.). **A new Pest of Watermelon—*Liriomyza citrulli* Rohdendorf, sp.n. (Diptera, Agromyzidae).** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 82–84, 1 fig. Moscow, 1950.

A description is given of the adults of both sexes of the Agromyzid, *Liriomyza citrulli*, sp. n., examples of which were reared in June, 1944, from larvae found mining in the cotyledons and stems of watermelons near Kherson, in the southern Ukraine.

[Kozhanchikov (I. V.).] Кожанчиков (И. В.). **The Cycle of Development and the geographical Distribution of the Winter Moth *Operophthera brumata* L.** [*In Russian.*]—*Ent. Obozr.* **31** no. 1–2 pp. 178–197, 1 map, 7 graphs, 28 refs. Moscow, 1950.

A detailed study was made in Leningrad of the relation between temperature and the development of *Operophtera brumata* (L.). Observations were carried out in the field in 1935–41 and in the laboratory in 1939–40. The geographical distribution of the moth is reviewed, and it is pointed out that it is most abundant in the zone of broad-leaved deciduous forest, optimum conditions for existence occurring along the southern coast of the Baltic Sea and in adjoining countries. Its food-plants include numerous fruit trees. The literature on the relation of climate to the life-cycle of the moth is discussed [*cf. R.A.E.*, A **5** 269; **23** 62; **26** 52, 420; **35** 283].

A comparison of the dates of emergence of the adults in European Russia showed that they become progressively later from north to south, the moths emerging in September–October near Leningrad, in December–January in the southern Crimea and in November–February in Transcaucasia. Since the females usually oviposit on the day of emergence and the development of the eggs and larvae in spring is rapid, pupation occurring at the end of spring or the beginning of summer, variations in the duration of the pupal stage are responsible for the differences in the dates of adult emergence.

The reaction of the various stages of *O. brumata* to climatic conditions was very complex. The eggs undergo a diapause in winter, and the period of autumn development, before the diapause, was about as long as the period of spring development, after it, but autumn development was possible between −2·5 and 26°C. [27·5–78·8°F.] and spring development only between 6 [42·8°F.] and 26°C. The corresponding temperature sums required [*cf.* **13** 389; **23** 296] were 131 and 79 day-degrees C. [235·8 and 142·2 F.]. The breaking of the diapause required exposure to low temperature. Eggs that developed in autumn at 5–10°C. [41–50°F.] and were not subjected to temperatures below 0°C. [32°F.] died at the end of winter at all temperatures between 3 and 25°C. [37·4–77°F.] without having resumed development. For elimination of the diapause, eggs that had developed in autumn at temperatures above 0°C. required exposure for at least two months to temperatures below it. On the other hand, eggs that were laid in October and developed until early December at temperatures that frequently fell to between −1 and −4°C. [30·2–24·8°F.] gave rise to normal larvae about a month after having been transferred to warm conditions, without exposure to cold during the diapause. All hatched when transferred to 15°C. [59°F.], but none did so at 5°C., though all remained viable, and 38 and 96 per cent. died at 20°C. [68°F.] and 25°C. respectively. The eggs proved resistant to humidity, especially in autumn, but those that developed under dry conditions in autumn (whether at high or low temperature) were killed by high humidity during the diapause.

The threshold of development of the larvae was about 3·5°C. [38·3°F.], but the larval stage lasted 2–3 months at 5°C. The temperature sum necessary for development varied from 280 to 320 day-degrees C. [504–576 F.].

depending on thermal conditions, and averaged 300 [540]. It was least at 14–18°C. [57·2–64·4°F.], the optimum for development. The larvae proved fairly resistant to high temperature and survived daily exposure for 6–8 hours to 30–32°C. [86–89·6°F.], but did not complete their development at average temperatures above 27–28°C. [80·6–82·4°F.]. Development appeared to be favoured by low temperature, and larvae that developed at high temperatures gave rise to pupae that developed slowly and suffered high mortality, even under optimum conditions. Thus, when the larvae developed at 11°C. [51·8°F.], the pupal stage averaged 105 days at 12–14°C. [53·6–57·2°F.], as compared with 144·4 days for pupae from larvae that developed at 25°C., and the mortality percentages were 25·6 and 70·5. This indicates that in years in which the spring is warm and the summer hot, pupal development will be prolonged and adult emergence delayed for an average of over a month. The larvae were more resistant to starvation at medium that at high temperatures. Thus, at 12–13°C. [53·6–55·4°F.], over 50 per cent. survived starvation for a week, but the duration of development of the resulting pupae averaged 135·6 days and 82 per cent. of them died, as compared with 113·5 days and 48 per cent. mortality for pupae from larvae that fed normally.

The lower and upper limits of development of the pupae were 4–5°C. [39·2–41°F.] and about 27·5°C. [81·5°F.], and in contrast to the findings of Speyer [**27** 99], the average duration of the pupal stage increased from 119·8 to 144·6 days as the temperature rose from 9·8 to 16·3°C. [49·6–61·3°F.]. It was about four months at 11–14°C. [51·8–57·2°F.] and the adults emerged in mid-October, at about the same time as in the field near Leningrad. Few pupae that were kept at 17–20°C. [62·6–68°F.] and none kept at 27°C. [80·6°F.] gave rise to adults. They survived for several months at 25°C. however, and it appeared that pupae can aestivate at high temperatures for about two months without ill effects. When the larvae fed normally and the pupae did not aestivate, the threshold of development was 4°C. [39·2°F.], and the temperature sum for development at 10–16°C. [50–60·8°F.] was 720–1,800 day-degrees C. [1,296–3,240 F.].

The adults were very resistant to cold and survived cooling to –15°C. [5°F.], but normal activity was possible only at temperatures above 0°C. The optimum lay between 5 and 11°C.; all the eggs were fertilised at these temperatures, whereas some were not fertilised at others and all were sterile at 25°C. The length of life of the females decreased from about 31 to about two days as the temperature rose from 0 to 27°C., and it was also short below 0°C.

It is concluded from the work that years with a wet cool summer and a long moderately wet autumn, with no long periods of frost, are likely to favour an increase in the population of the moth, whereas hot dry years with short frosty autumns are unfavourable.

COLLYER (E.). **A Method for the Estimation of Insect Populations on Fruit Trees.**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 148–151, 2 pls., 1 fig., 5 refs. East Malling, 1951.

A description is given of a method for the accurate estimation of insect populations that was adopted for use on apple in south-eastern England in 1950 during investigations on the predators of the fruit-tree red spider mite [*Paratetranychus pilosus* (C. & F.)] [*cf. R.A.E.*, A **41** 158, etc.]. The whole tree is rapidly enveloped in a cloud of insecticide, which causes rapid knockdown of the insects on to a sheet beneath the tree, whence they are collected and counted. The insecticide consists of 0·3 per cent. pyrethrins as pyrethrum extract in a mixture of light and heavy hydrocarbon oils

(3:1) and is dispersed from six bottle atomisers, arranged round the tree on the ground and connected with a distributing unit fed by pressure from a cylinder of compressed air or nitrogen. Screens are placed round the tree to confine the cloud of insecticide, and the ground sheet is 12 ft. square, with a collar tying round the trunk and a border 9 ins. high round the edge. The method proved suitable for use on apple trees 15 years old.

In one preliminary test on the effect on predators of sprays applied against the summer stages of the mite, the results of which are cited as an example of the use of the method, examination on 8th July showed the presence of 1,062, 1 and 1,285 examples of the most numerous predator, *Blepharidopterus angulatus* (Fall.), on single trees that had received no spray or one of 0·06 per cent. parathion or 0·09 per cent. di(p-chlorophenoxy)methane on 1st June, before many nymphs of this Mirid had hatched. Parathion thus remained toxic to the newly hatched nymphs for over five weeks, whereas the other compound had no persistent effect against them, though it killed the active stages at the time of application.

Blair (C. A.). **Damage to Apple Leaves by the Fruit Tree Red Spider Mite,** *Metatetranychus ulmi* **(Koch).**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 152–154, 2 pls., 6 refs. East Malling, 1951.

The results are given of investigations on the internal damage caused to apple leaves by the feeding of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.). The mite usually feeds from the lower surface of the leaf, and much internal damage may occur before any external sign appears. Most of the mites that hatch from the winter eggs occur on the central leaves of the tree, and these are the first to show external damage. In feeding on the lower surface, the mite forces its stylets through the epidermis, through the spongy mesophyll tissue and into a cell of the palisade tissue. Only the cell actually penetrated by the stylets is injured; the chloroplasts disappear from it, and the starch is more or less seriously depleted.

In 1950, winter eggs were found as early as 12th July on trees in an orchard in Essex that had received no dormant-oil or summer sprays and were heavily infested, with severely damaged leaves in the centre and badly damaged leaves throughout. There were none on trees that showed low mite populations and little damage, and it is possible that the winter eggs were laid when the badly damaged leaves provided insufficient food [*cf. R.A.E.*, A **39** 197]. Varieties of apple vary in their reaction to mite attack, and measurement of transverse sections of apple leaves in 1949–50 showed that it was not the thickness of the leaf but the number of palisade layers that affected the apparent severity of damage. Leaves with only one layer of palisade mesophyll show damage under the upper epidermis immediately they are attacked, whereas similar damage to the first layer in varieties that have two or three is masked by the other layers, and a large mite population is necessary to produce visible injury. Increased leaf area may also reduce the visible damage caused by a given population by increasing the food available.

Marlé (G.). **Observations on the Dispersal of the Fruit Tree Red Spider Mite,** *Metatetranychus ulmi* **(Koch).**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 155–159, 2 graphs, 5 refs. East Malling, 1951.

During investigations in Essex on the control of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), it was found that orchards that had received an effective late application of winter oil were sometimes as

heavily infested by the end of the summer as in previous seasons [*cf.* *R.A.E.*, A **39** 284].

Overwintering eggs are sometimes introduced on nursery stock or on graftwood, and immature and adult mites on tools or clothes, but the main danger to uninfested orchards is that the mites themselves disperse in large numbers from neighbouring orchards. Dispersal occurs from apple when the leaves are badly damaged as a result of the infestation. The mites lower themselves on silken threads, and investigations on the conditions affecting this were made by means of a wind tunnel and by suction traps, adhesive bands and oiled plates in orchards.

In the wind tunnel, in which air speeds of 2·5, 5 and 10 miles per hour were tested, it was found that descent occurred only when the air was completely still. Only females were observed descending on threads, though the immature mites spun small threads while being transferred from leaf to leaf. Males did not spin threads or disperse. Females descended sooner after a wind of low speed than after a high wind and only at average temperatures of 70°F. or more and relative humidities of about 50 per cent.

Field experiments confirmed that dispersal was not involuntary. Counts of mites caught on oiled plates hung facing the prevailing wind in infested apple and plum orchards showed that dispersal occurred when the numbers of adults on the trees reached a maximum; adult females much outnumbered other forms among those caught. In suction traps, most mites were caught in calm periods. Natural dispersal was observed five times in 1949 and twice in 1950, usually on calm evenings after warm days; the females hung from threads in bunches until a breeze broke the threads, and then drifted away. Hedges of sloe (*Prunus spinosa*) were observed to serve as centres of infestation; the mites also oviposited on weeds, but it seems unlikely that these are an important source of reinfestation.

Predators [*cf.* **41** 158, etc.] sometimes reduce high populations of the mite to such an extent that dispersal becomes unnecessary; in 1950, the Coccinellid, *Stethorus punctillum* Weise, and the Mirid, *Blepharidopterus angulatus* (Fall.), reduced the numbers of eggs laid by mites of the second and third generations to such an extent that there was very little dispersal in the third generation and hardly any in the fourth or fifth, and in 1947 a very high population of winter eggs was eliminated by the Coniopterygid, *Conwentzia pineticola* End. Tests with adhesive bands showed that there was practically no movement of mites up and down the trunks, and it is unlikely that they could return to the trees in numbers once they had fallen to the ground.

Kirby (A. H. M.). **Trials of Zinc Fluoroarsenate against Codling Moth, *Cydia pomonella* L.**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 160–163, 2 refs. East Malling, 1951.

The standard method of controlling *Cydia pomonella* (L.) on apple in Britain is to spray the trees with acid lead arsenate, usually at 2 lb. per 100 gals., during June. When used with hard water, or in combination with lime-sulphur at less than 2 per cent., the lead arsenate decomposes to yield a water-soluble compound, which sometimes causes partial defoliation of the trees. Zinc fluoarsenate, which was developed as an insecticide in Sweden during the war, was said to release no soluble arsenic when added to weak lime-sulphur solutions, and determinations of soluble arsenic in mixtures of 0·2 per cent. lead or zinc fluoarsenate and 0·5–2 per cent. lime-sulphur showed that it released much less than did lead arsenate. It was therefore tested on several varieties of apple in 1948–50 and at 0·2 per

cent. gave almost as good control as lead arsenate on the variety Charles Ross in 1948 and 1950, but proved inferior on this variety and Worcester Pearmain in 1949. Both zinc fluoarsenate and lead arsenate with 1 per cent. lime-sulphur caused significant increases in leaf-fall on Cox's Orange Pippin in 1949, but not on Worcester Pearmain in 1949 or on either variety in 1950. It is concluded that zinc fluoarsenate offers no advantage over lead arsenate for the control of *C. pomonella* [*cf. R.A.E.*, A **36** 180].

Kirby (A. H. M.) & McKinlay (K. S.). **Laboratory Experiments on the Toxicity of potential Acaricides.**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 164–171, 14 refs. East Malling, 1951.

An account is given of further laboratory tests of organic compounds for the control of summer eggs and adult females of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) carried out at East Malling in 1949–50 by the dipping technique previously employed or modifications of it [*cf. R.A.E.*, A **38** 296; **39** 49]. The toxicants were generally used at concentrations of 0·1 and 0·025 per cent. in a mixture of 2 per cent. acetone, 0·05 per cent. cyclohexylamine dodecyl sulphate and 0·02 per cent. dioctyl sodium sulphosuccinate.

Parathion and paraoxon both gave complete kills of the adults, but paraoxon gave better control of the eggs than parathion; isopropyl-parathion [O, O-diisopropyl O-p-nitrophenyl thiophosphate] was less effective against the eggs, and methyl-parathion very inferior. An analogue of paraoxon, diethyl p-chloro-m-methylphenyl phosphate, was ineffective against the eggs, but a 0·1 per cent. suspension of O,O-diethyl O-7-hydroxy-4-methyl-coumaryl thiophosphate gave 89·2 per cent mortality. Chlordane, toxaphene and γ BHC were ineffective against the eggs, but aldrin and dieldrin caused about 50–70 per cent. mortality; 0·1 and 0·025 per cent. toxaphene gave 50 and 1·2 per cent. mortality, respectively, of the adults.

At 0·1 per cent., N-amyl cyclohexylamine, N,N-amyl-benzoyl cyclohexylamine and N,N-amyl-benzyl cyclohexylamine gave 54·2, 67·6 and 71·5 per cent. kill of the eggs and 19·2, 70 and 100 per cent. of the adults, and at 0·025 per cent., the first two were ineffective, but the last gave 75·6 and 52·2 per cent. kill of eggs and adults, respectively. Diphenylcarbinol (benzhydrol), bis(o-chlorophenyl)carbinol and bis(p-chlorophenyl)carbinol gave 53·6, 42·4 and 60 per cent. kill of eggs at 0·1 per cent., and bis(p-chlorophenyl)methylcarbinol (DMC) gave 78·7 and 68·9 per cent. at 0·1 and 0·025 per cent., respectively, in this test and was even more effective in others. Benzyl benzoate gave negligible kills of eggs, but about 65–73 per cent. kill of adults; toxicity was increased by chlorinating to p-chlorobenzyl benzoate or benzyl-p-chlorobenzoate, the former being the more effective against the eggs and the latter giving almost complete kill of the adults. Chlorination at both ends of the molecule, to form p-chlorobenzyl p-chlorobenzoate, reduced toxicity. Benzyl benzoate was of interest in the field, as predators of *P. pilosus* were much more active on trees sprayed with it than on those treated with other acaricides; the chlorinated compounds should also be tested in the field, as the effect on predators cannot be determined in the laboratory. Phenyl benzenesulphonate had only moderate toxicity to the eggs, but phenyl p-chlorobenzenesulphonate, p-chlorophenyl benzenesulphonate and p-chlorophenyl p-chlorobenzenesulphonate gave 86·1, 94·7 and 92·4 per cent. kill at 0·1 per cent., and the last two were also very toxic at 0·025 per cent.

In tests of the acaricidal effect of fungicides that might be used against apple scab [*Venturia inaequalis*], N-(trichloromethylthio)-tetrahydrophthalimide (SR406), in 5 per cent. acetone, 0·05 per cent. cyclohexylamine dodecyl

sulphate and 0·02 per cent. dioctyl sodium sulphosuccinate, had considerable ovicidal action, but two alkyl glyoxalidine fungicides were ineffective. Arathane (25 per cent. wettable dinitrocaprylphenylcrotonate), which has been shown to be effective against *V. inaequalis* and the mite [**38** 499] and was used without supplements, gave promising control of both eggs and adults. Other materials tested against both stages comprised m-cresyl benzoate and p-cresyl benzoate, which were no more effective than benzyl benzoate, benzoyl anilide, which was ineffective, and azobenzene and azoxybenzene, which were very effective, but are too phytotoxic for field use. Against the eggs, diphenyl sulphone and p-chlorophenyl-chloromethyl sulphone were effective at 0·1 per cent., and the active constituent of Aramite, 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite, showed considerable toxicity, but is unlikely to prove of value for field control.

When applied in the standard formulation to the upper surfaces of leaves bearing eggs on the lower surfaces, rotenone at 0·01 per cent. (2·5 times the concentration used against adults in the field), DMC and diphenyl sulphone at 0·2 per cent. (four times and twice the strength required for direct ovicidal action) gave no control, whereas 0·1 per cent. azobenzene, 0·1 per cent. p-chlorophenyl p-chlorobenzenesulphonate and p-chlorophenyl benzenesulphonate (normal field strength) and 0·05 per cent. paraoxon and parathion (five times the normal field strength for parathion) showed marked toxicity, paraoxon being superior to parathion, and p-chlorophenyl benzenesulphonate twice as effective as its analogue. The ability of at least two chlorinated phenyl benzenesulphonates to permeate leaves may be of value in the greenhouse, where adequate cover of the undersides of leaves is difficult to obtain, and also in the orchard, where it may permit less thorough spraying.

Comparison of these results with those recorded for other mites [*cf.* **38** 377] indicates that the order of effectiveness is not the same for all species, so that each requires separate testing.

McKinlay (K. S.), Kirby (A. H. M.) & Allen (M.). **Experiments on increasing the Penetration of Ovicides and Insecticides.**—*38th Rep. E. Malling Res. Sta. 1949–50* pp. 177–186, 5 refs. East Malling, 1951.

A contact poison should possess considerable lipoid solubility if it is to penetrate the outer layers of cuticle of an insect or mite or the shells of their eggs, but penetration may be assisted by the addition of a non-toxic solvent that readily penetrates lipoid membrane, and some materials have been shown to act in this way [*R.A.E.*, A **34** 87]. A suitable penetrant might reduce the quantity of toxicant necessary or increase the effectiveness of toxicants with poor powers of penetration. Tests were therefore carried out, mainly with benzyl alcohol as the penetrant, against overwintering eggs of *Aphis pomi* Deg., *Operophtera brumata* (L.) and *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), summer eggs of the mite, and adults of *Tribolium confusum* Duv. In most of the tests the poisons were dissolved in acetone with emulsifying and wetting agents and added to water to form standard emulsions containing 2 per cent. acetone, 0·05 per cent. cyclohexylamine dodecyl sulphate and 0·02 per cent. dioctyl sodium sulphosuccinate. Stable emulsions were not formed when benzyl alcohol was used with diphenylamine, azobenzene or diphenyl sulphone in the standard formulation, and the concentrations of acetone and the emulsifying and wetting agents used with these materials were therefore increased to 9, 0·1 and 0·04 per cent., respectively. The effect on the eggs was estimated by a dipping technique.

In tests in 1949, the addition of 2·5 per cent. benzyl alcohol increased the kills of winter eggs of *P. pilosus* given by emulsions containing 0·05 per cent. n-dodecyl thiocyanate, 0·2 per cent. azobenzene or 0·025 per cent. azoxybenzene from 0–2·3 to 99·5–100 per cent. and those given by 0·2 per cent. diphenylamine or 0·05 per cent. bis(p-chlorophenyl)-methylcarbinol from 2·9 and 48·3 to 77·4 and 88·2 per cent., respectively, but did not improve the poor control given by diphenyl sulphone, which is a good summer ovicide, showing that benzyl alcohol can act as a penetrant for several materials, but does not necessarily make ovicides that control the summer eggs effective against the winter ones. In 1950, benzyl alcohol increased the effectiveness of 0·05 per cent. n-dodecyl thiocyanate, 0·2 per cent. azobenzene and 0·2 per cent. diphenylamine; when added to the first two, it resulted in almost complete kill at 2 per cent. and increased toxicity at 0·5 per cent., whereas with the third it increased the percentage mortality from 20·9 to 86·5 at 5 per cent. and was ineffective at 2·5 per cent. Mixtures containing 0·05, 0·0125 and 0·00625 per cent. azoxybenzene with 1·25, 2·5 and 5 per cent. benzyl alcohol, respectively, gave practically complete kill, though neither material gave appreciable mortality alone at these concentrations. Benzyl alcohol was ineffective at concentrations below 1 per cent., and would thus be too expensive for practical use.

In order to find a cheaper or more powerful penetrant, tests of the effect on penetration of the winter eggs of the mite were made with compounds structurally related to benzyl alcohol. Those studied were: 2-phenylethyl alcohol and 3-phenylpropyl alcohol, in which the polar and non-polar parts of the molecule are separated by longer chains; p-tolyl-carbinol, in which an alkyl group is added to the non-polar end of the molecule; piperonyl alcohol, a variant of the same type forming part of the piperonyl-butoxide molecule; ethylene glycol monobutyl ether (butyl cellosolve), the other end of the piperonyl-butoxide molecule; β-phenylethylamine and its isomer, α-phenylethylamine, in which the hydroxyl group is replaced by an amino group; monoethanolamine, a short-chain molecule bearing both amino and hydroxyl groups; 2,4-xylen-1-ol; and p-benzyl-m-cresol. When added at a concentration of 2 per cent., the xylenol, phenylethyl alcohol, phenylpropyl alcohol, tolyl carbinol, piperonyl alcohol and β-phenylethylamine increased the toxicity of 0·03 per cent. azoxybenzene, which showed considerable toxicity alone in this test, and α-phenylethylamine, monoethanolamine and butyl cellosolve decreased it, presumably by reducing the amount of toxicant passing through the lipoid layer; benzyl cresol gave complete mortality alone. Tests to determine whether toxicity was greatest when both poison and penetrant were acid, when both were basic or when acid and alkali were mixed, in which DNC and diphenylamine were used with benzyl alcohol or benzylamine as the penetrant in one test and with m-cresol, quinoline and methyl benzoate in another, gave inconclusive results. Neither benzyl alcohol nor benzylamine was toxic alone at 3 per cent., but, whereas benzyl alcohol acted as a penetrant for both ovicides, benzylamine increased kill by diphenylamine only. At 2 per cent., quinoline alone killed nearly all the eggs and m-cresol over half of them, whereas methyl benzoate was only slightly toxic. The first was not shown to increase the kill by either ovicide, the second increased that by both and the third that by DNC only.

In tests in 1949 on eggs of *A. pomi*, the addition of 1·25–5 per cent. benzyl alcohol to 0·1 per cent. of an alkyl thiocyanate containing 48 per cent. n-dodecyl ester in the standard emulsion caused little more mortality than that expected from the combined activities of the individual compounds, and the addition of 1·25–5 per cent. carbitol (diethylene glycol monoethyl ether) less than that from carbitol alone. In tests in 1950 with 0·01 per cent. parathion in the same formulation, the addition of 2 per cent. benzyl alcohol

did not increase mortality, though the alcohol caused 4·5 per cent. toxicity alone. It is therefore concluded that these compounds did not act as penetrants in the case of the Aphid eggs. The parathion emulsion caused 98·3 per cent. mortality of eggs of *O. brumata* without a penetrant and 99·6 per cent. in the presence of 2 per cent. benzyl alcohol, which, alone, caused 31·4 per cent. mortality, and there was therefore again no evidence of penetrant effect.

Although summer eggs of the mite are susceptible to more toxicants than the winter eggs, no entirely satisfactory ovicide has been found for field use, and 0·125–2 per cent. benzyl alcohol was therefore tested as a possible penetrant for 0·025 per cent. parathion and 0·01 per cent. azobenzene, and 1 per cent. hexylene glycol or piperonyl butoxide for 0·01 per cent. azobenzene. Benzyl alcohol was itself toxic, but reduced the toxicity of both ovicides, hexylene glycol showed negligible toxicity, but reduced that of azobenzene, and the mortality due to azobenzene with piperonyl butoxide was less than the arithmetical sum of the mortalities due to these compounds.

Against adults of *T. confusum*, parathion and benzyl alcohol were tested as sprays in the standard emulsion, and diphenylamine and parathion with benzyl alcohol in dusts. To prepare the latter, the required amounts of insecticide and penetrant dissolved in acetone were added to 1 gm. celite, and the solvent was evaporated. In sprays, parathion alone at 0·003–0·008 per cent. caused mortalities reasonably proportional to concentration, whereas there was no such relation when 1 per cent. benzyl alcohol was added and no evidence of penetrant activity, except possibly at concentrations of 0·003–0·0037 per cent. parathion. There was no mortality of beetles allowed to crawl on dusts containing 8 per cent. benzyl alcohol alone, 22 per cent. on 2·5 per cent. diphenylamine alone, and 100 per cent. on 2·5 per cent. diphenylamine with 1·28 per cent. benzyl alcohol. The addition of 0·32 per cent. or less benzyl alcohol to 0·625–10 per cent. diphenylamine was ineffective. Parathion and benzyl alcohol appeared to be antagonistic in dusts, and mixing 0·05 per cent. parathion with 10–80 per cent. benzyl alcohol reduced mortality.

Melis (A.). **Esperienze di lotta contro il *Dacus oleae* Rossi nella Toscana litoranea nel 1949.** [Experiments on the Control of *D. oleae* (Gmel.) on the Coast of Tuscany in 1949.]—*Redia* **35** pp. 1–73, 13 figs. (1 fldg.), 4 refs. Florence, 1950.

Faldi (G.). **Rilievi sull'azione esplicata dagli insetticidi clorurati di sintesi sul *Dacus oleae* Rossi in prove di laboratorio e di pieno campo.** [Notes on the Effect of synthetic chlorinated Insecticides on *D. oleae* in Laboratory and Field Tests.]—*T. c.* pp. 129–172, 1 fig., 3 refs.

The first of these papers contains a detailed account of further field experiments in Tuscany in 1949 on the control of *Dacus oleae* (Gmel.) on olive [*cf. R.A.E.*, A **41** 105] and notes on laboratory tests, full descriptions of which are given in the second paper. In the field tests, the trees were sprayed four times at about monthly intervals, beginning in mid-July, with 0·5 per cent. technical chlordane, BHC (9 per cent. γ isomer) or DDT (the last in a fused powder and an emulsified solution), bordeaux mixture containing 1 per cent. copper sulphate and 1–4 per cent. lime, or two mixtures containing lime-sulphur and various other ingredients [*cf.* **26** 350], both of which have been stated to protect the fruits from oviposition.

Bait pans containing 5 per cent. diammonium phosphate were hung in the treated and in untreated trees, replenished every ten days and inspected daily throughout the season. There was some decrease in the numbers of adults taken in the pans on the treated trees, and to a less extent on the untreated ones, for a few days after each spray application, and there was also a decrease when rain and low temperatures coincided, but no treatment gave any considerable reduction in infestation of the fruits at harvest.

In the laboratory tests, which were similar in scope to those of the previous year [**41** 105], high mortality resulted when laboratory-bred adults of *D. oleae* were exposed to branches taken from the trees at various times after they had been sprayed with chlordane, DDT or BHC or to deposits from sprays of the three materials at the field concentrations and chlordane also at 0·2 per cent., applied in test-tubes, chlordane proving somewhat more persistent than the other materials on the branches. When infested olives sprayed in the field were caged in the laboratory, all these three insecticides gave some mortality of the adults that emerged, chlordane proving the most effective, and parasites were also killed.

Considerable numbers of adults were found on the ground under the trees shortly after the fourth application of DDT, BHC and chlordane, and all those taken to the laboratory died shortly afterwards.

Della Beffa (G.). **Osservazioni sulla biologia della dorifora in Piemonte nel 1949.** [Observations on the Biology of *Leptinotarsa decemlineata* in Piedmont in 1949.]—*Redia* **35** pp. 75–83, 1 pl. Florence, 1950.

The rate of development of *Leptinotarsa decemlineata* (Say) on potato in Piedmont [*R.A.E.*, A **38** 347] varies with altitude. In the plain, the first overwintered adults usually appear in the second half of April, but the majority do so in the first half of May. Large numbers appear in March when the spring is warm and wet but they re-enter the soil or seek other shelter in the absence of food, especially if cold weather returns. Potatoes are usually followed by cereals in this area, and after feeding on volunteer potato plants, the beetles migrate to fresh potato fields. Pairing occurs there, though many females are fertilised before overwintering, and the eggs are laid, at the rate of 400–1,800 per female, over a period lasting about a month, during which feeding continues. The eggs hatch in 5–15 days, and the larval and pupal stages last about 34 and 12 days, respectively. Thus most of the first generation adults appear at the beginning of July. Development of the second generation is more rapid, adults appearing at the end of August or beginning of September. As the potatoes are usually harvested in mid-August, the beetles migrate in search of food to *Solanum dulcamara*, *S. nigrum* and egg-plant (*S. melongena*), especially the last, and some attack tomato and peppers (*Capsicum annuum*), though damage is slight. Some of the females that emerge in August oviposit in the autumn, but the resulting third-generation larvae die from cold and lack of food. Hibernation occurs at the onset of cold weather, sometimes not before October or November, and the adults migrate in large numbers in search of suitable sites. They overwinter 8–14 ins. below the surface of the soil, and if there is little snow or humidity is excessive, winter mortality may be considerable. In the hilly districts of Monferrato and Alba, where the summer is hot and dry, the beetles aestivate and there is no third generation, whereas in those of Biella and Lake Maggiore, at the foot of the Alps, conditions are more favourable and damage is severe. In the Alpine

valleys at elevations of 4,000–5,000 ft., where the summer is cool and short, there is only one generation a year, the overwintered adults appearing in June.

The natural enemies of *L. decemlineata* observed in Piedmont include, in addition to those already noticed [**38** 347–348], the Pentatomid, *Zicrona coerulea* (L.), which is predacious on the larvae [*cf.* **36** 196].

DE PIETRI-TONELLI (P.). **Contributo alla conoscenza della biologia del *Ceuthorrhynchus pleurostigma* Marsh. (Coleoptera Curculionidae).** [A Contribution to Knowledge of the Biology of *C. pleurostigma*.]—*Redia* **35** pp. 85–128, 12 figs., 3 graphs, 18 refs. Florence, 1950.

The author gives brief descriptions of all stages of *Ceuthorrhynchus pleurostigma* (Marsh.), reviews its distribution, life-cycle, food-plants and natural enemies from the literature, and gives an account of observations on its bionomics in Venice in 1946–47, with details of the local climate. There was only one generation in the year. The adult weevils emerged from the soil at the beginning of May and fed on wild and cultivated crucifers, showing no particular preference for cultivated varieties. They disappeared from the field at the end of May and were not found again on the plants until the beginning of September. Individuals kept in cages during the summer sheltered in crevices in the soil and beneath stones and fed occasionally on leaves, and it is concluded that this is the natural behaviour during the hot season. No eggs or larvae were observed on crucifers during this period. When the weevils reappeared, they resumed feeding on crucifers and paired. The eggs were laid from the beginning of September to the end of October, singly in the collar and underground parts of the stems [*cf. R.A.E.*, A **35** 423]. The larvae hatched in 5–6 days and caused the formation of galls. When several eggs were laid in close proximity, the galls were united in one large protuberance. The larvae fed within these, enlarging them in the process. They ceased feeding in December and remained inactive until February, when they resumed feeding and entered the woody parts of the stems. Towards the end of the month and in March, when they were fully fed, the larvae left the galls and constructed earthen cells about 2 ins. below the surface of the soil, in which they pupated. The pupal stage lasted about 15 days.

The damage done by the adults in spring and autumn was slight, and though the feeding of the larvae in the stalks retarded the growth of the plants somewhat, it did not destroy them. Methods of control are reviewed [**14** 615; **35** 385; **36** 281]. In a laboratory test, larvae within the galls were killed when the soil round the roots of the plants was watered with a parathion emulsion.

MELIS (A.). **Cenni storici sulla comparsa e diffusione della dorifora (*Leptinotarsa decemlineata* Say) in Europa con particolare riferimento all'Italia.** [Historical Notes on the Appearance and Spread of *L. decemlineata* in Europe with special Reference to Italy.]—*Redia* **35** pp. 185–204, 46 refs. Florence, 1950.

The author describes the spread of *Leptinotarsa decemlineata* (Say) on potato in Europe and records its distribution in Italy up to the end of 1949. In addition to the districts already noticed [*R.A.E.*, A **37** 446; **38** 347], the beetle had by then spread to Tuscany, where it was first reported from the Provinces of Florence and Massa in 1948.

Delucchi (V.). **L'allevamento in massa di** *Apanteles rubecula* **Marsh., Braconide endoparassita di** *Pieris rapae* **L.** [The Mass Rearing of *A. rubecula*, a Braconid Endoparasite of *P. rapae*.]—*Redia* **35** pp. 205–224, 4 figs., 4 graphs, 7 refs. Florence, 1950. (With a Summary in English.) **Note morfologiche su** *Tetrastichus rapo* **Walker, Calcidide parassita di Imenotteri utili all'agricoltura.** [A morphological Note on *T. rapo* Wlk., a Parasite of Hymenoptera useful to Agriculture.]—*T.c.* pp. 441–450, 6 figs., 6 refs.

The work described in the first of these papers was begun in July 1949 with a view to the despatch of cocoons of *Apanteles rubecula* Marsh., a parasite of *Pieris rapae* (L.), to Australia by early October. Cocoons of the Braconid were collected in the first instance from cabbage north-east of Lake Maggiore, in Switzerland, and as 45 per cent. of them gave rise to hyperparasites, which were identified as *Tetrastichus rapo* (Wlk.), rearing was begun in the laboratory. The adults of *A. rubecula* emerged from the cocoons in about a week and were transferred in batches of 10–15 to tubes, and filter paper dipped in a water solution of sugar and peptone was supplied to them daily. Pairing took place almost immediately, and the females were ready to oviposit soon afterwards. Both sexes survived for 15–20 days. Pieces of cabbage leaf bearing eggs of *P. rapae* were collected in September and placed in petri dishes lined with fresh leaves and covered with gauze. They were inspected daily for hatching, and when the larvae were two days old they were introduced one by one into the tubes containing the ovipositing parasites. The latter were attracted to the larvae by a light placed at the end of the tube, and when eggs had been laid in a host, it was removed to a petri dish lined with cabbage leaves, which were renewed every two days. Mortality of the eggs and the parasitised larvae was high. The egg and larval stages of the parasite together lasted 11 days at 19–23°C. [66·2–73·4°F.], cocoons being found 10 days after oviposition, and 15 days at 17–18°C. [62·6–64·4°F.]. To prevent the parasites from forming their cocoons on the dishes, the contents of the latter were removed to a gauze bag two days before emergence from the host was due. The gauze was later cut up and sent with the cocoons on it in special boxes to Australia by air, food being provided for any adults that emerged on the way.

Observations on material not sent to Australia showed that the pupal stage normally lasted about 10 days and complete development 18–26 days, with an average of 21.

The second paper contains a detailed description of the hyperparasites identified as *T. rapo*. They were reared from cocoons of *A. rubecula* and also from those of *A. glomeratus* (L.), a parasite of *P. brassicae* (L.), and were morphologically identical. Some of them would have been referable to *T. galactopus* (Ratz.) according to the view of Faure [*R.A.E.*, A **14** 115–116], but the author considers that the differences in coloration do not justify specific rank for the latter.

Dal Monte (G.). **Osservazioni su alcune partite di grano importate in Italia nel primo semestre del 1950.** [Observations on some Consignments of Wheat imported into Italy in the first six Months of 1950.]—*Redia* **35** pp. 225–250, 1 ref. Florence, 1950. **Una inconsueta infestazione di grano da parte di** *Plodia interpunctella* **Hb.** [An unusual Infestation of Wheat by *P. interpunctella*.]—*T.c.* pp. 381–384, 2 figs., 1 ref.

The author reports in the first of these papers that considerable amounts of wheat were imported into Italy, mostly from Argentina, during 1950 for storage. As it was desired to avoid losses caused by insects, samples were

examined for infestation on arrival and again later, so that control measures could be applied if necessary. Samples of wheat grown in Italy were examined concurrently. The methods adopted comprised not only macroscopic and microscopic examination, with identification of the insects found, but also one described by J. C. Frankenfeld for determining oviposition by *Calandra* spp. In this, samples of wheat are immersed for 2–5 minutes in a mixture of 0·5 gm. acid fuchsin, 50 cc. glacial acetic acid and 950 cc. distilled water, which stains the egg plugs of the weevils a deep cherry red, whereas feeding punctures and mechanical injuries are stained light pink. This method did not prove reliable for imported grain, since many of the egg plugs had become detached owing to repeated handling in transit, and it was not always easy to distinguish the shades of colour produced, but it appeared effective for Italian wheat, which had been less disturbed.

During the first six months of the year, 60 samples were examined in these various ways, and the results of the examinations are shown in a table and discussed. Many of the samples proved not to be infested, and infestation, which was in no case particularly heavy, was not always detected at the first examination. It was heaviest in wheat from Argentina. The species found were *C. oryzae* (L.), *C. granaria* (L.), *Rhizopertha dominica* (F.), *Laemophloeus* (*Cryptolestes*) *ferrugineus* (Steph.), *Oryzaephilus surinamensis* (L.), *Tenebroides mauritanicus* (L.), *Sitotroga cerealella* (Ol.), *Tribolium castaneum* (Hbst.), *T. confusum* Duv., and the predacious mite, *Pediculoides ventricosus* (Newp.), from Argentina, *C. oryzae*, *R. dominica* and *Tenebroides mauritanicus* from the United States, and *C. granaria* from Syria. Italian wheat was infested by *C. oryzae*, *L. ferrugineus*, *T. mauritanicus*, *S. cerealella* and *Dibrachys cavus* (Wlk.) (*boucheanus* (Ratz.)), which is an ectoparasite and was probably attacking *S. cerealella*.

It is recorded in the second paper that some of the samples of imported wheat became infested in the laboratory by *Plodia interpunctella* (Hb.), females of which oviposited on the wire gauze used to cover the jars in which the grain was kept.

Martelli (M.). **Contributi alla conoscenza dell'entomofauna del granoturco** (*Zea mays* **L.). II. Aphidoidea.** [Contributions to the Knowledge of the Insect Fauna of Maize. II. Aphids.]—*Redia* **35** pp. 257–380, 26 figs., refs. Florence, 1950.

In this second part of a series [*cf. R.A.E.*, A **27** 174], the author gives a table showing the Aphids that are common on maize in Italy, those that are found on maize in other parts of Europe and occur in Italy but infest maize sporadically or not at all there, and those that attack it in continents other than Europe. The taxonomy, distribution and food-plants of the species of the first two groups are discussed, largely from the literature, information is given on their morphology and bionomics, with records of collection in Italy, and a key to them is appended.

Ciampolini (M.). **Esperienze di lotta contro il** *Dacus oleae* **Gmel. con insetticidi a base di esteri fosforici.** [Experiments on the Control of *D. oleae* with Insecticides based on Phosphoric Esters.]—*Redia* **35** pp. 393–406, 1 graph, 1 ref. Florence, 1950.

During work on the control of *D. oleae* (Gmel.) on olive on the coast of Tuscany in 1950, trees in a small isolated plantation were dusted with 2 per cent. parathion or sprayed with 0·2 per cent. of a wettable powder containing 15 per cent. parathion. Treatments were applied on 4th September,

when infestation of the olives was already heavy, and, after a period of bad weather, on 23rd and 28th September and 2nd October. The effect on the larvae in the fruits [*cf. R.A.E.*, A **41** 47] was investigated by examining olives from branches enclosed in gauze bags for 7–10 days after treatment or collected on successive days after it, and that on the adults by comparing the numbers caught in bait-pans containing 5 per cent. diammonium phosphate, which were hung in the trees from June onwards. There was no effect on the larvae or their Hymenopterous parasites in the fruits and this was confirmed when infested olives were dusted or sprayed in the laboratory, but there were considerable reductions in the numbers of adults taken after treatment, as compared with the controls, and the percentages of olives that were infested on treated and untreated trees averaged 14·7 and 37·5, respectively, in late September and 35 and over 99 on 20th October.

In a laboratory test on the toxicity of parathion to adults of *D. oleae* and its effect on their parasites, *Eurytoma rosae* Nees and *Eupelmus urozonus* Dalm., adults were caged with treated and untreated branches at different periods after treatment. It was found that both the spray and the dust gave rapid and complete mortality of the fruit-fly and the parasites immediately after treatment, the spray acting more rapidly than the dust, but that their effectiveness was lost in about a week. Adults of *Dacus* alighting on treated trees were removed to gauze cages containing a sugar solution as food. Mortality occurred within 2–3 hours, but the effectiveness of the insecticide declined rapidly and toxicity was lost after 4–5 days.

Fenili (G. A.). **Osservazioni biologiche e prove di lotta contro la mosca delle ciliege** (*Rhagoletis cerasi* **L.**). [Biological Observations on *R. cerasi* and Experiments on its Control.]—*Redia* **35** pp. 451–464, 19 refs. Florence, 1950.

Observations on the bionomics and control of *Rhagoletis cerasi* (L.) on cherry were made in the Province of Pisa in 1950 on six trees of one variety and four of another. Only one overwintering puparium could be found, and observations on the adults had, therefore, to be made by means of bait-pans, which were hung in the trees from 30th April onwards. The attractant first used was 5 per cent. diammonium phosphate, renewed every six days, but as this did not give good results, it was later replaced by an infusion prepared by soaking 0·8 lb. bran in 1 gal. water in a warm atmosphere for 24 hours, during which fermentation occurred, and filtering. The infusion was renewed every three days.

The first adult was taken on 24th May and the last on 11th June, and infestation was relatively light. Oviposition occurred in late May, and puparia were observed between 18th June and 4th July in rearing cages in which infested fruits were placed on 8th and 18th June. They were slightly smaller than usual, possibly owing to the fact that the cherries had been picked before ripening. An adult emerged from one of the puparia in July 1950, and the rest overwintered and were kept for observations in the following year. In the tests on control, some trees of each variety were sprayed on 29th May and again, after rain, on 31st May with a product containing 4 per cent. parathion, 16 per cent. BHC, 70 per cent. organic solvents and 10 per cent. emulsifiers. Examination of fruits of the two varieties showed that the infestation percentages were 4·9 and 9·9 on 6th June, 23·1 and 6·7 on 15th June and 27·2 and 6·6 on 26th June, as compared with 3·2 and 2·1, 42·7 and 22·6, and 40·4 and 20, respectively, for no treatment.

Geier (P.). **La lutte contre les Acariens phytophages en arboriculture fruitière.**—*Landw. Jb. Schweiz* **65** pt. 9–10 pp. 911–930, 12 graphs, 10 refs. Berne, 1951.

Considerable damage has been caused to fruit trees in Switzerland during the past ten years by Tetranychid mites. The most important of these are *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), which is the most injurious and occurs throughout the country, *Tetranychus telarius* (L.) (*urticae* Koch), which is common in French Switzerland, and *Bryobia praetiosa* Koch, which is harmful only in the Valais. The winter eggs of *P. pilosus* hatch in mid-April, and there are 5–6 generations between then and November. The trees attacked, in order of decreasing importance, are apple, plum, peach and pear. *T. telarius* is polyphagous and appears to infest fruit trees in Switzerland only accidentally, attack resulting from the presence of heavily infested plants beneath the trees or from carriage by wind. The females hibernate under the bark of the trees but apparently leave these in spring and lay their eggs on low-growing plants. Infestation of the trees occurs sporadically in the course of the summer. *B. praetiosa* attacks apple and pear, and the winter eggs, which hatch as the buds are bursting, and most of the summer ones, are laid on the woody parts of the tree. The young mites migrate to the buds and leaves, and there are several generations a year. In addition, there are various species of secondary importance, including an unidentified species of *Tetranychus* (*Eotetranychus*) that was found on apple near Lausanne.

Natural enemies are the main factor in control, and the effects of various spray treatments on them and on the mites were studied in 1950 on apple in two orchards near Lausanne in which winter eggs of *P. pilosus* were numerous. Counts of the mites were made every 15 days, by a technique similar to that of Baten & Hutson [*R.A.E.*, A **32** 115]. The mites increased on untreated trees until the middle or end of June, after which they were checked by the Coccinellid, *Stethorus* (*Scymnus*) *punctillum* Weise, and Anthocorids. The relatively late appearance of these predators on the trees may have been due to a preference for *T. telarius*, which was already numerous on other plants when *P. pilosus* was beginning to hatch. Occasional attacks by *T. telarius* occurred in July in one orchard, and *Tetranychus* (*Eotetranychus*) sp. was present in small numbers in the other. A winter spray of DNC in oil was insufficient to prevent a slight increase in infestation by *P. pilosus* at the end of June and the beginning of July, and caused a slight delay in the appearance of the predators. Three applications of sprays of DDT or lead arsenate against *Cydia* (*Enarmonia*) *pomonella* (L.) had no direct effect on the mites, but DDT killed the predators over a long period and caused a dangerous outbreak at the end of July [*cf.* **40** 283]. At the end of the season, the trees sprayed with lead arsenate were the more heavily infested of these two groups, as the predators had by then moved to the trees treated with DDT, attracted by the heavy mite infestation. Sprays of lime-sulphur or wettable sulphur did not prevent mite increase or control an outbreak caused by DDT. The use of fungicidal carbamates also favoured an increase in mite infestation by destroying the predators [*cf.* **38** 499]. Parathion was effective in limiting the initial populations but did not give prolonged control in the absence of predators. Treatment with a systemic phosphorus compound before the summer eggs were laid almost completely destroyed the initial populations but also failed to prevent later increases when predators were not present. Rotenone products appeared to be effective for late-season control against *P. pilosus* and also killed the eggs when combined with mineral oils, but are incompatible with sulphur fungicides.

It is recommended that DDT and fungicidal carbamates injurious to

the predators should not be applied between June and August and that initial populations of the mites should be controlled by a phosphorus compound, preferably systemic in action, at petal-fall.

Baggiolini (M.), Geier (P.) & Mathys (G.). **Contaminabilité par le pou de San-José** (*Quadraspidiotus perniciosus* **Comst.) des végétaux ligneux les plus communs en Suisse.**—*Landw. Jb. Schweiz* **65** pt. 9–10 pp. 931–937, 3 refs. Berne, 1951.

In connection with work on the control of *Quadraspidiotus perniciosus* (Comst.) in Switzerland [*cf. R.A.E.*, A **39** 204, etc.], investigations were made in the Ticino on the range of food-plants of this Coccid. The experimental plants were grown in pots and kept in contact with fruit trees heavily infested by *Q. perniciosus*. The experiments covered the 2–3 summer generations, and observations were continued throughout the ensuing year. Lists are given of the numerous species on which reproducing females developed, and of those on which they did not. The former are classified as those that permitted the development of infestation, those that permitted a limited infestation that died out naturally, and those on which reproduction was very limited and infestation died out rapidly.

Mathys (G.) & Geier (P.). **Elaboration d'une méthode de fumigation cyanhydrique (HCN) permettant le traitement sous bâches de végétaux fruitiers en production attaqués par le pou de San-José** (*Quadraspidiotus perniciosus* **Comst.).**—*Landw. Jb. Schweiz* **65** pt. 9–10 pp. 938–947, 3 graphs, 16 refs. Berne, 1951.

Investigations were begun in Switzerland in the winter of 1947–48 on the fumigation of dormant fruit trees infested by *Quadraspidiotus perniciosus* (Comst.) with hydrocyanic acid gas under tents. The gas was generated by the pot method from sodium cyanide, sulphuric acid and water in the proportions used in the experiments in fumigation chambers [*R.A.E.*, A **40** 18], other methods proving unsuitable at the prevailing low temperatures. The concentrations given are those initially applied.

The work in the first season showed that the hot HCN rose to the top of the tent, leaving a region of sublethal concentrations at the base. In more detailed tests in 1950 and 1951, in which the HCN was released at 1 and 2 oz. (2 and 4 oz. sodium cyanide) per 100 cu. ft. under tents about 141 cu. ft. in volume, of 6 oz. U.S. Army duck, it was found that the height of the zone of low concentration was proportional to the height of the tent (3·25, 6·5 or 13 ft.), mortality at the two dosages in the lower 16 ins. after 30 minutes being complete in tents 3·25 ft. high and only 60 and 98·5 per cent., respectively, in those 13 ft. high. Gas concentrations at ground level fell more rapidly at the higher than at the lower dosage and were very low after 15 minutes. The zone of low effectiveness was not eliminated by reversing the normal procedure and adding the sulphuric acid and water to the sodium cyanide, to retard the generation of the HCN, which then gave unsatisfactory results throughout the tent owing to leakage and possibly to incompleteness of the reaction, but was reduced by increasing the gas concentration, though even 5 oz. HCN per 100 cu. ft. did not give complete mortality in the lower 8 ins. in a tent 13 ft. high. Variations of temperature between −5°C. and 10°C. [23°F. and 50°F.] and the presence of moisture on the trees and of snow or mud on the ground had no effect on the results. When a screen of fine cloth was placed across a tent 13 ft. high, to delay the rising of the gas, complete mortality was obtained in all parts of the tent with a concentration of 1 oz. HCN per 100 cu. ft., but a simpler technique was desired. Two pots

were therefore used in each tent, one with a piece of cardboard 32 ins. square placed 8–12 ins. above it, which kept the fumigant generated from it in the lower part of the tent, and another, without a screen, from which the HCN rose to the top of the tent. Tests by this technique showed that complete mortality was obtained, without injury to the trees, when the amounts of sodium cyanide used were 5 and 3 oz. per 100 cu. ft., respectively, for the pots with and without the screen, and fumigation was continued for 30 minutes.

Schneider (F.). **Eine einfache Vorrichtung zur quantitativen Anwendung insektizider Stäubemittel im Laboratorium.** [A simple Apparatus for the quantitative Application of insecticidal Dusts in the Laboratory.]—*Z.PflKrankh.* **56** pt. 1–2 pp. 10–19, 4 figs., 16 refs. Ludwigsburg, 1949.

The author reviews laboratory techniques for applying insecticidal dusts evenly and at measured rates for experimental purposes, and describes an apparatus that is rapid and simple to operate and gives deposits varying by not more than 8 per cent. It consists of a rubber pipe partially closed with a clip and fitted at one end with a rubber-bulb air pump, and a bell jar with a bottle-neck top in which is inserted a short glass tube with the lower end drawn out to form an inverted funnel, having a rubber stopper so placed in it that moderate air pressure forces it out. The stopper remains attached to a thread. Air spaces are left between the glass tube and the neck of the jar. To use the apparatus, the jar is placed over the surface to be dusted and the requisite quantity of powder placed in the glass tube, where it rests on the stopper. The rubber pipe is fitted to the tube and air pumped in until the pressure forces out the stopper. The dust is released in a cloud in the jar and settles in 0·5–3 minutes. Even distribution depends on the quantity of compressed air, and this can be controlled by moving the clip along the rubber pipe. Some examples are given of the ways in which the apparatus is used to test dusts against various insects.

Rademacher (B.). **Beobachtungen über die Kellerlaus (*Myzodes* (*Rhopalosiphoninus*) *latysiphon* Dav.).** [Observations on *R. latysiphon*.]—*Z.PflKrankh.* **56** pt. 1–2 pp. 22–26, 1 fig., 6 refs. Ludwigsburg, 1949.

Rhopalosiphoninus (*Myzodes*) *latysiphon* (Davidson) has become more numerous and widespread on stored potato tubers in Germany since the war, and its distribution there is briefly reviewed from the literature. In investigations by the author, the Aphids were commonest on tubers stored in cellars and fed mainly on the sprouts, and although they were observed once in the field, on the underground parts of potato plants near Stuttgart in 1947, all died in tests in which infested tubers were planted in sand in containers or in soil in the field [*cf. R.A.E.*, A **40** 216]. In rearing experiments in the dark at 18–19·5°C. [64·4–67·1°F.], development was anholocyclic, no sexuales or eggs being observed. The young Aphids moulted when 3, 5–6 and 11 days old [*cf.* **39** 419], and the apterae began to reproduce when 12–14 days old. They lived for up to 46 days and produced an average of 25 young each, with a maximum of 34. In further tests, optimum reproduction occurred in darkness or in diffused light, and one variety of potato was preferred to several others. Alates were present in small numbers at all times and were most numerous in mid-summer. They were positively phototactic and flew when released. In the few cases in which they were observed to land, they sheltered from direct sunlight beneath stones or vegetation and stayed there until they died.

Infestation is spread mostly by means of the tubers and persists in the

cellars from year to year on vegetable remains. It reduced the quality of potatoes for the table, and delayed sprouting in the field, with a consequent loss of yield, of a susceptible variety. In experiments in 1947–48 on the ability of the Aphid to serve as a vector of potato viruses, in which examples that had fed on infected sources were transferred to healthy tubers, these being subsequently planted and the plants protected from *Myzus* (*Myzodes*) *persicae* (Sulz.) by a weekly spray, only one case of mosaic and one of leaf-roll developed among 462 plants. None occurred in a small greenhouse test in 1948. It is concluded that *R. latysiphon* is at most only an occasional vector. Recommendations for control include dusting the stored tubers with DDT (Gesarol), BHC, or E 605 Staub [methyl-parathion], fumigation with nicotine, and the maintenance of low temperatures in store cellars until well into the spring.

Lüdicke (M.). **Über das Eindringungsvermögen des Insektizids E 605 f in lebende pflanzliche Gewebe.** [On the penetrating Power of the Insecticide E 605 f in living Plant Tissue.]—*Z. PflKrankh.* **56** pt. 1–2 pp. 31–36, 4 figs., 2 refs. Ludwigsburg, 1949.

The author describes experiments carried out at the same time as those already noticed [*R.A.E.*, A **40** 374] on the ability of E 605 f [a parathion emulsion concentrate] to penetrate into leaves and kill larvae of an Agromyzid mining in them, whether applied to limited areas on the upper or lower surface or sprayed over the leaves.

Schaerffenberg (B.). **Über die Eintrittsstellen der Kontaktgifte und die Ursachen der DDT-Resistenz der Maikäferlarve.** [On the Sites of Entry of Contact Poisons and the Causes of Resistance to DDT in Larvae of *Melolontha*.]—*Z. PflKrankh.* **56** pt. 1–2 pp. 37–39. Ludwigsburg, 1949.

Contact insecticides, including DDT, act on insects mainly by way of the extremities, and it is suggested that the principal sites of entry are the areas of weakly chitinised integument covering the leg joints and the points of insertion of sensory hairs or bristles. Saltatoria possess large joints, particularly in the rear legs between tibia and femur. Mortality of grasshoppers (*Stenobothrus*) and field crickets (*Gryllus campestris* L.) was complete after 2–3 days when DDT in a thick suspension was applied to these joints, whereas all the insects survived when the leg surface was treated. Adults of *Musca domestica* L., the legs of which are well provided with sensory hairs, all died after treatment of the legs with DDT, whether it was applied to the joints or to the leg surfaces, but larvae of *Melolontha*, which are resistant to DDT, were not affected by treatment in either way. It is concluded that the joints of the latter are too small for injurious doses to penetrate the cuticle, and that resistance or susceptibility to DDT is related to the physical structure of the extremities.

Lehmann (H. C.). **Luzerneschädlinge. 6. Die vier Gallmückenarten der Luzerne, nebst einigen Bemerkungen über** *Contarinia torquens* **de Meij. (Nach mehrjährigen Beobachtungen in Thüringen.)** [Lucerne Pests. 6. The four Species of Lucerne Gall-midges, with some Remarks on *C. nasturtii*. (Several Years' Observations in Thuringia.)]—*Z. PflKrankh.* **56** pt. 3–4 pp. 96–104, 6 refs. Ludwigsburg, 1949.

Of the four Cecidomyiids of lucerne considered in this part of a series, which is based mainly on observations made in 1933–41 in Thuringia, *Contarinia medicaginis* Kieff. causes considerable damage [*cf. R.A.E.*, A **22** 493;

27 457], *Dasyneura ignorata* (Wachtl) was rarely of importance [*cf.* **22** 494], and *Asphondylia mikii* Wachtl and *Jaapiella medicaginis* (Rübs.) were uncommon [**22** 494; **23** 595]. In observations in 1933–40, the dates on which the first flowers galled by *C. medicaginis* were found in the field and the first adults emerged in the laboratory varied by only 10 and 8 days, respectively, in the different years, and were thus not dependent on weather and the state of growth of the lucerne. The abundance of the species varies directly with soil humidity and inversely with insolation in March–June [*cf.* **27** 457], and the same was found to be true of *C. nasturtii* (Kieff.) (*torquens* de Meij.) on cruciferous vegetables.

The author previously considered *C. onobrychidis* Kieff., which causes flower galls on sainfoin (*Onobrychis sativa*), to be a distinct species [**22** 493], but Hedicke, to whom he submitted specimens, found that they did not differ morphologically from *C. medicaginis*. In view of the biological differences, however, *onobrychidis* is retained as a subspecies of the latter. The adults of *onobrychidis* appear about 14 days earlier than those of *medicaginis*, and their flight period is shorter. In Thuringia in 1940, *onobrychidis* was injurious only where sainfoin was grown for seed. Since this crop is being gradually replaced by lucerne, the importance of the Cecidomyiid is decreasing.

D. ignorata had two generations a year, in spring and summer. The spring generation was the more injurious, but was in most years effectively controlled by parasites. The larvae live gregariously in galls on the shoots and caused considerable losses in 1924 and 1937.

Mieller (H.). **Der grosse braune Rüsselkäfer** (*Hylobius abictis* **L.), ein Vorratsschädling ?** [*H. abietis* a Pest of Stored Products?]—*Z. PflKrankh.* **56** pt. 5–6 pp. 198–200, 5 figs. Ludwigsburg, 1949.

In October 1948, apples and beans stored in two houses in Hamburg were damaged superficially by adults of *Hylobius abietis* (L.), which had apparently been introduced with peat and firewood. In small-scale feeding experiments, pears were preferred to apples and also to twigs of spruce, which is the normal food-plant of the weevil, although these were readily accepted in the absence of alternative food.

Haine (E.). **Zur Frage der Überwinterung von** *Myzodes persicae* **Sulz. an Sekundärwirten: I. Das Vorkommen der grünen Pfirsichlaus an Wintergemüse der Kölner Bucht und ihrer Randgebiete im ausgehenden Winter 1948/49.** [Contributions to the Question of Overwintering of *Myzus persicae* on secondary Hosts: I. The Occurrence of *M. persicae* on Winter Vegetables in the Cologne " Bay " and its Environs in the late Winter of 1948–49.]—*Anz. Schädlingsk.* **23** pt. 6 pp. 81–86, 2 figs., 17 refs. Berlin, 1950.

Since *Myzus* (*Myzodes*) *persicae* (Sulz.) is known to overwinter on its summer food-plants in various parts of southern and western Europe, investigations were made in the spring of 1949 to ascertain whether it does so near Bonn, at the southern end of the so-called Cologne " bay " (lowlands). Cultivated crucifers, mangels and spinach at Bonn itself and at a series of localities rising to altitudes of 500–650 ft. on either side of the Rhine were examined between 16th March and 5th April, following a cold spell in February and early March and before migration began from peach. The Aphid was found at all the localities investigated, though it was commonest at the lower altitudes and rare at 650 ft., and was much more numerous on the left bank of the Rhine than on the right. Infestation was

heaviest at Bonn itself, where the numbers of Aphids per plant averaged 14·8 on brussels sprouts and 59·5 on savoy cabbage and all plants of these varieties were infested. The Aphids were much less common on other varieties of cabbage and on spinach, and rare on mangel and turnip rape; they did not occur on rape or on weeds growing in the fields. Aphids were in general most numerous on the plants that had been set out earliest, but they were scattered rather than in dense colonies. In some places at the higher altitudes, only immature stages occurred, which indicated that the adults had been killed by the cold spell. The Aphid was also found overwintering in unsprayed greenhouses and on fodder beet and potato tubers in cellars, though it was much less common than *Rhopalosiphoninus latysiphon* (Davidson) on the tubers.

Schwartz (E.). **Wirkung von E 605-f auf Eier des Kartoffelkäfers.** [The Effect of E 605 f on Eggs of the Potato Beetle.]—*Anz. Schädlingsk.* **23** pt. 6 p. 87, 1 ref. Berlin, 1950.

In laboratory tests in Germany in 1947, eggs of the potato beetle [*Leptinotarsa decemlineata* (Say)] were treated with 0·025, 0·04 or 0·1 per cent. E 605 f [an emulsion concentrate containing 70 per cent. parathion] either on the day of oviposition or 1–4 days later. The percentages that hatched were 62, 58 and 0 for the 3 concentrations, respectively, as compared with 68 for no treatment, and of the larvae obtained, 97–100 per cent. died in a few days, having fed but little, as compared with 1·5 per cent. Those from eggs treated on the fourth day after oviposition died in the shortest periods.

Götz (B.) & Madel (W.). **Über stärkeres Auftreten der " Roten Spinne " an Reben und Versuche zu ihrer Bekämpfung.** [On a severe Outbreak of Red Spider on Vines and Attempts to control it.]—*Anz. Schädlingsk.* **23** pt. 6 pp. 89–90, 2 figs. Berlin, 1950.

Grape vines in various parts of southern Baden were seriously injured in 1949 by *Tetranychus telarius* (L.) (*althaeae* v. Hanst.), which had also apparently been numerous in previous years. Infestation was heavy on plants growing near walls and paths overgrown with brambles (*Rubus*) and on a vine terrace adjoining an orchard. In experiments on control, sprays of 0·015 and 0·03 per cent. E 605 forte [an emulsion concentrate containing 50 per cent. parathion] gave only 42 and 55 per cent. mortality, and a proprietary BHC preparation was no more effective, but it is considered that appreciable damage could be avoided by spraying 3 times at intervals of 8–10 days, beginning early in the year.

Groschke (F.). **Zum gegenwärtigen Stand der Engerlingsbekämpfung mit Hexa-Präparaten und deren Anwendungsmöglichkeit in der forstlichen Praxis.** [On the present State of Control of Melolonthid Larvae with BHC Preparations and the Possibility of their Use in Forest Practice.]—*Anz. Schädlingsk.* **23** pt. 7 pp. 98–100, 5 refs. Berlin, 1950.

Since BHC dusts have been shown to be effective against larvae of *Melolontha* in the soil [*cf. R.A.E.*, A **37** 443, etc.], four methods of applying them were tested in April 1949 in forest nurseries near Würzburg. The first two were for use before planting, and consisted of either broadcasting the insecticide on the surface and working it in during soil cultivation, or scattering it in the holes in which the tree seedlings were to be planted. In the other two, which were intended for areas in which young plants were

already growing, the BHC was applied either in holes made in the soil at the rate of about 12–18 per sq. yard, or in furrows between the rows, and covered immediately. In all cases, the BHC was used at the rate of 0·3 oz. per sq. yard and the results were evaluated in the following November. The first and third methods, which were the most economical, were tested on light soil and both gave complete mortality of larvae and prevented reinfestation for the rest of the year. All four methods were tested on heavy clay soil, but only the second afforded protection. It is concluded that dusts are effective in light soils but that emulsified solutions are required for general control in heavy soils. In view of reports that BHC is less effective in alkaline soils, the use of lime should be avoided if BHC treatment is intended.

Helm (A.). **Massenauftreten des Wollafters,** *Eriogaster lanestris* **L.** [A Mass Outbreak of *E. lanestris*.]—*Anz. Schädlingsk.* **23** pt. 7 pp. 104–106, 3 figs., 14 refs. Berlin, 1950.

In July 1949, lime trees [*Tilia*] bordering a road in north-eastern Saxony were found to have been defoliated by larvae of *Eriogaster lanestris* (L.), which were present in very large numbers. The larvae spun communal nests, some up to 2 yards long and 10 ins. thick, on the branches and sheltered in them during the day. When the outbreak was discovered, most of the larvae were ready to pupate, and many were observed crawling on and in buildings. The bionomics and food-plants of the Lasiocampid are reviewed from the literature, and possible methods of control are discussed.

Riemschneider (R.) & Rohrmann (B.). **Über die Zucht DFDT-resistenter** *Drosophila melanogaster* **M.** [On the Breeding of *D. melanogaster* resistant to Fluoro-DDT.]—*Anz. Schädlingsk.* **23** pt. 10 pp. 148–149, 1 fig., 4 refs. Berlin, 1950.

During laboratory investigations on insecticides that contain fluorine [*R.A.E.*, A **40** 9, 10], a strain of *Drosophila melanogaster* Mg. was bred from adults in each successive generation that survived contact with a film of p,p′fluoro-DDT in closed petri dishes. Films that caused 70 and 100 per cent. mortality of normal flies after contact for 2 and 2½ hours, respectively, caused only 30 and 50 per cent. mortality of the 32nd generation of the resistant strain.

Gauss (R.). **Speckkäfer** (*Dermestes lardarius* **L.**) **als Schädling in Presskork.** [*D. lardarius* injurious to pressed Cork.]—*Anz. Schädlingsk.* **23** pt. 10 pp. 154–155, 3 figs., 2 refs. Berlin, 1950.

Articles made of ground pressed cork bound together with an adhesive were found after four years' storage in a factory in Germany to have been severely damaged by insects. Investigations showed that the injury was caused by larvae of *Dermestes lardarius* L., which had bored into the cork in search of pupation sites. The goods had been stored near sacks of casein, which is sometimes used as the adhesive, and these were found to be infested by larvae of the Dermestid. Adults in the cork survived heat treatment at 120°C. for 12 hours, but not for eight days. Fumigation with hydrocyanic acid gas or ethylene oxide or, for goods in small quantities, carbon bisulphide or carbon tetrachloride, is recommended for control. Cork goods should be stored away from casein and manufactured with adhesives that are not subject to infestation.

Mühle (E.) & Fröhlich (G.). **Vergleichende Untersuchungen über *Brachyrrhinus* (=*Otiorrhynchus*) *ligustici* L. und *Liophloeus tessulatus* Müll. und deren Beziehungen zum Liebstöckel, *Levisticum officinale* Koch.** [Comparative Investigations on *Otiorrhynchus ligustici* and *Liophloeus tessulatus* and their Relation to *Levisticum officinale*.] —*Beitr. Ent.* **1** no. 1 pp. 1–41, 20 figs., 117 refs. Berlin, 1951.

A stand of *Levisticum officinale*, which is grown for its aromatic and medicinal properties, was found near Leipzig in the late summer of 1948 to be infested by weevil larvae. It was thought that the species would prove to be *Otiorrhynchus* (*Brachyrrhinus*) *ligustici* (L.), but adults found later were determined as *Liophloeus tessulatus* (Müll.), which has not previously been considered of economic importance in Germany. Linnaeus described *O. ligustici* from *Levisticum officinale* (*Ligusticum levisticum*), but as that weevil has not been reliably recorded from this plant in the more recent literature and his description, which is quoted, might apply to more than one species, the five specimens in the Linnaean collection were examined. All proved to be identical with the *O. ligustici* of later authors. The synonymy of *O. ligustici* is reviewed, and descriptions are given of the eggs, larvae and adults of both species and the pupae of *Liophloeus tessulatus*.

Observations on the bionomics of *O. ligustici* showed that the adults, which are unable to fly, emerged from the soil at the end of March or the beginning of April and sheltered on the surface until the temperature exceeded 25°C. [77°F.], when they migrated in search of suitable plants for maturation feeding, which lasted from early April to about the end of May. They are often injurious to young beet, but have been known to attack plants of many species, a list of which is given. No males were found in 1949 or 1950 [*cf. R.A.E.*, A **26** 520] and females kept in isolation reproduced parthenogenetically. Oviposition began about mid-May, the weevils laying 100–400 eggs each in the soil near the roots of lucerne, which is the chief food-plant, and clover. The larvae, which cause the main injury, hatched in 3–4 weeks, fed on the roots of the plants, and overwintered in the soil at depths of 12–16 ins. Feeding was resumed early in the spring, and pupation occurred in the soil in mid-July, the pupal stage lasting 21–26 days. The adults remained in the pupal chambers until the following spring. Larval development was considerably prolonged in damp, heavy soil.

The life-cycle of *L. tessulatus* was similar. The adults emerged in late April or early May, when the soil temperature at a depth of 20 ins. reached 9–10°C. [48·2–50°F.], and fed on the leaves of *Levisticum officinale* and also occasionally on those of angelica (*Archangelica officinalis*) or other plants. No males were observed, and reproduction was parthenogenetic. Oviposition began in mid-May, eggs being laid in batches of 10–100 on the lower surfaces of the leaflets and covered with another young leaf. The oviposition period lasted 1–3 weeks, and 350–750 eggs were laid per female. The larvae hatched in 21 days in the laboratory and in 23 days in the field, in late May. They migrated to the base of the plants, and fed on the root-collar and roots. Feeding was renewed after hibernation, and pupation occurred in July or early August. The adults remained in the pupal chambers until the following spring.

The distribution of the two species in Europe and the damage caused are discussed. In food-plant tests, adults of *O. ligustici* fed little on angelica and hardly at all on *Levisticum*, but readily attacked lucerne. Those of *Liophloeus* preferred *Levisticum*, but fed and oviposited on angelica and accepted various other plants in the absence of more suitable food. The literature on the natural enemies of *O. ligustici* is reviewed. In the

authors' observations, adults of both species were attacked by the fungus, *Beauveria bassiana*, which gave considerable mortality of *Liophloeus*. Up to 70 per cent. of the eggs of the latter were parasitised by the Mymarid, *Anaphes brachygaster* Debauche, and about 40 per cent. of the larvae were infected with a bacterial disease. Since the habits of *O. ligustici* and *L. tessulatus* are similar, the control measures applied against the former should be effective against the latter.

VON OETTINGEN (H.). *Thrips tabaci* **Lindem. als Erbsenschädling.** [*T. tabaci* as a Pest of Peas.]—*Beitr. Ent.* **1** no. 1 pp. 42–43, 1 fig. Berlin, 1951.

The pods of peas picked in June 1945 in a district in Saxony were found to bear eggs and oviposition scars of thrips, and larvae and adults of *Thrips tabaci* Lind. were subsequently reared from them. The pods were rendered unsightly by typical marks of feeding, but the peas within were not injured. Large quantities similarly affected were seen on sale in the summer.

CALTAGIRONE Z. (L.). **Observaciones sobre** *Arrenoclavus koehleri* **(Blanchard) (Hym., Chalc., Encyrtidae).** [Observations on *A. koehleri*.]—*Agric. téc.* **11** no. 1 pp. 20–34, 9 figs., 17 refs. Santiago, Chile, 1951. (With a Summary in English.)

Arrenoclavus koehleri (Blanch.), a polyembryonic Encyrtid parasite of *Gnorimoschema operculella* (Zell.) on potato, was found in Chile for the first time in 1944. The author reviews its systematic position [*R.A.E.*, A **39** 255] and distribution [**39** 58] and gives brief descriptions of the adults of both sexes. Investigations on its bionomics were begun in the laboratory in 1949 and were followed by experiments on mass breeding for release in the field to supplement natural control. No other host is known.

The female oviposits in the host egg immediately after emergence, and the parasites hatch within the host larvae. At 18–20°C. [64·4–68°F.] and 65 per cent. relative humidity, the egg stage lasted 22 days, and the larvae fed for eight days. The host larva spins its cocoon but dies without pupating, and the parasites pupate in the dead host and are then clearly visible in it. The pupal stage lasted eight days. The numbers of adults that developed per host averaged 31·7, and all those from the same polyembryonic egg were of the same sex, unfertilised eggs giving rise to males. The ratio of males to females was 1:3·43.

The apparatus used in the mass breeding experiments is described. Material was obtained from field-infested potato tubers. Larvae of *G. operculella* that left these were allowed to spin cocoons in sand, and the larvae and pupae were then removed from their cocoons by immersion in a 6 per cent. solution of sodium hypochlorite [*cf.* **34** 142]. Examples that were not parasitised by *A. koehleri* were used to provide a laboratory stock of the host, which was reared by a method based on that of Finney, Flanders & Smith [**39** 279, etc.], and parasitised larvae were kept individually in tubes so that parasite adults of the two sexes could be obtained separately. These were transferred to oviposition cages with honey smeared on the sides, at the rate of two or more females to one male, and the next day, cloth on which eggs of *G. operculella* had been laid was spread on the bottom. The cloth was removed after two days and placed in contact with potato tubers that had been pitted to facilitate entry. The host cocoons were

removed and examined after 24 days, and the parasitised larvae were used for further breeding. Nearly 5,000 parasitised larvae of *G. operculella* were obtained up to June 1951, and most of them were distributed in the Provinces of Coquimbo, Valparaiso and Santiago. Parasitism does not normally exceed 20 per cent. in the field, but it is considered that this might be considerably increased by releases in early spring.

CABALLERO V. (C.). **Notas biológicas y económicas sobre la conchuela negra** (*Saissetia oleae*). [Biological and economic Notes on *S. oleae*.]—*Agric. téc.* **11** no. 1 pp. 54–63, 3 figs., 5 refs. Santiago, Chile, 1951. (With a Summary in English.)

Laboratory and field experiments near Santiago, Chile, in 1947–49 showed that *Saissetia oleae* (Bern.), an important pest of olive and other fruit trees there, has only one complete generation a year [*cf. R.A.E.*, A **31** 206–207]. Oviposition occurred from October to March, reaching a peak in mid-December. Individual females oviposited for 8–10 weeks, and six laid an average of 1,500 eggs each. The first eggs to be laid hatched in about a month, and hatching reached a peak in the second half of December. The three nymphal instars lasted about 5–7, 11–13 and 20–22 weeks, respectively. After remaining under the parent female for 1–2 days, the crawlers attached themselves, usually to a leaf, and during the last nymphal instar the majority migrated to the branches, where they attached themselves and became adult. No males have been recorded from Chile. Descriptions are given of all stages of *S. oleae*, with special reference to the growth of the antennae, which facilitates identification of the various nymphal instars. *Scutellista cyanea* Mots. [*cf.* **31** 207] gave about 50 per cent. control of the scales and was most abundant in heavily infested or abandoned plantings. Sprays of 1 and 1·5 per cent. oil emulsion were tested in the laboratory, and the latter controlled the Coccid even in the last nymphal instar, in which it overwinters. Treatment should be applied between the first autumn rains and mid-winter.

CABALLERO V. (C.). **Aspectos biológicos y de control de la "conchuela morada del manzano".** [Biological Aspects of *Lepidosaphes ulmi* L. and its Control.]—*Agric. téc.* **11** no. 1 pp. 91–92. Santiago, Chile, 1951.

In view of the poor control given by sprays of mineral oil applied in the winter against *Lepidosaphes ulmi* (L.) on apple and pear in Chile, investigations on the bionomics of the Coccid were carried out on apple in Santiago in 1947–49. It was found that it overwintered in the egg stage. Hatching occurred between the end of September and mid-October, the crawlers moulted after about a fortnight, and the adults appeared ten days later. The fertilised females began to oviposit at the end of December. The resulting eggs hatched in a month, and the first moult occurred at the beginning of February and the second at the end of that month. Females of this generation oviposited between the end of March and June. In tests on control in spring, sprays of 1 and 1·5 per cent. summer oil emulsion applied on 16th October 1947, when all the overwintered eggs had hatched, gave 68·1 and 98 per cent. mortality, respectively, in 25 days, and a 2 per cent. spray applied on 25th October 1948 gave 88·4 per cent. mortality in 20 days. These treatments are compatible with the early lead-arsenate sprays applied against *Cydia* (*Carpocapsa*) *pomonella* (L.).

Hayward (L. A. W.). **Contamination caused to sacked decorticated Groundnuts by direct Spraying with aqueous Suspensions of BHC and DDT.**—*J. Sci. Fd Agric.* **2** no. 11 pp. 524–527, 2 refs. London, 1951.

Decorticated groundnuts in sacks have been stored in the open in Nigeria in recent years in 750-ton pyramids, 50 ft. square at the base and constructed on raised platforms, and in early 1949 heavy infestation, particularly by *Tribolium castaneum* (Hbst.), made emergency treatment necessary at Kano. Aqueous suspensions of BHC and DDT were applied to the pyramids with a mechanical orchard sprayer to give deposits of 360 mg. DDT and 12 mg. γ BHC per sq. ft. of surface area [*cf. R.A.E.*, A **40** 265].

In order to determine the proportion of the insecticide that became associated with the expressed oil and groundnut cake, the surfaces of two pyramids were sprayed on 24th March 1949 with 40 gals. water containing 10 lb. 6·5 per cent. γ BHC or 60 lb. 20 per cent. wettable DDT, which resulted in deposits of 39 mg. γ BHC (302 mg. total isomers) and 725 mg. DDT, respectively, per sq. ft. Tarpaulins were put over the stacks a few days later in readiness for the rainy season. After six months, the stacks were uncovered, sacks were removed from the surface layer, and oil was pressed from the groundnuts in them. From analyses of oil, cake and groundnuts, it was calculated that, throughout the pile, these contained averages of 2·5, 1 and 1·5 p.p.m. total BHC and 4·7, 1 and 1·8 p.p.m. DDT, respectively. These quantities are within the limits tolerated in the United Kingdom, and it is concluded that as the dosages were more than twice those used in practice, there is no danger of contamination by normal treatments when the whole of a pile is considered, though individual external bags may contain relatively high residues. Very considerable mixing of the external and internal sacks occurs after they leave the piles.

Somade (B.). **Contamination and Taint of Cocoa Beans by residual Insecticides.**—*J. Sci. Fd Agric.* **2** no. 11 pp. 527–528. London, 1951.

During experiments in southern Nigeria in 1948–50 on the use of insecticides to protect stored cacao from infestation by insects [*cf. R.A.E.*, A **40** 266, 267], two tests were made on the possible contamination of the beans with DDT and BHC. In the first, the beans were placed in impregnated sacks and transported to Lagos, where they were examined three weeks later. The contents of DDT and BHC (total isomers) in the sacks were 3·45 and 1·65 per cent., respectively, at the beginning of the test and 2·8 and 0·93 per cent. at the end of it, and the beans were then found to contain averages of 1·05 p.p.m. DDT and 1·3 p.p.m. BHC; the testa contained 4·31 and 2·7 p.p.m., and the cotyledons 0·67 and 1·1 p.p.m. The temperature throughout the test was not lower than 26°C. [78·8°F.]. No taint due to BHC was recorded, but in view of the rather high residues, more tests are necessary before its general use can be recommended.

The second test concerned the spraying of warehouse walls with suspensions of insecticides, which results in heavy deposits at the base and on the floor if excessive run-off is allowed. As the beans are stored on the floor for grading, sometimes to a height of 2–3 feet up the walls, attempts were made to estimate the amount of DDT or BHC they are likely to take up. Two opposite walls of a shed were sprayed with DDT and BHC to give dosages of 600 and 40 mg. per sq. ft., respectively, at floor level, and cacao beans were stored against them and moved about at intervals for a week, which is much longer than in normal practice, and then sieved; at that time, the odour of BHC was pronounced. Analyses showed that the beans had absorbed 2·8 p.p.m. DDT and 1·9 p.p.m. BHC (total isomers), which are well below the tentative limits permitted.

Stein (L. H.), Alper (T.) & Anderssen (E. E.). **The Movement of a radiophosphorus-labelled Insecticide in Groundnut Plants.**—*J. Sci. Fd Agric.* **3** no. 1 pp. 31–37, 2 figs., 5 refs. London, 1952.

In the course of experiments in the Transvaal in 1949–51 on the effectiveness of spraying with schradan as Pestox 3 to protect groundnuts from attack by *Aphis craccivora* Koch (*leguminosae* Theo., *laburni*, auct.), the vector of the virus that causes rosette disease of this crop [*cf. R.A.E.*, A **36** 426, etc.], schradan synthesised from radioactive phosphorus (P^{32}) was used in a systematic study of its movement in the plants.

Preliminary tests, in which plants that were flowering and setting nuts were sprayed with radioactive schradan in February 1950, showed that the radioactivity per plant diminished rather rapidly, very little remaining in the green parts after 14 days, that there was considerable radioactivity after 14 days in soil shaken from the roots, and that radioactivity per gm. plant weight was highest in the nuts and lowest in the old parts of the plant after a few days.

In a more detailed test in the summer of 1950–51, radioactive Pestox 3 containing about 95 per cent. schradan was applied in a spray at 3 lb. per acre, and sample plants were assayed immediately and 1–25 days afterwards. The tops of the plants were cut off at ground level and treated so that radioactivity due to schradan and that due to its decomposition products could be assayed separately. Roots, nuts and soil samples to a depth of 5·2 ins. were assayed for total radioactivity only. It was found that the decrease in radioactivity in the tops was due to loss of schradan as a whole, and that the compound did not decompose appreciably until about three weeks after spraying. The largest loss was due to evaporation immediately after spraying, but there were further losses by movement into the roots, nuts and soil; the radioactivity in the roots and soil increased regularly with time. No significant correlation was found between depth and soil radioactivity, except that the upper 1·3 inches contained more than any of the three lower layers of that thickness.

Gairaud (R.) & Besson (J.). **Contribution à l'étude de la biologie du bupreste du pêcher (*Capnodis tenebrionis* L.) dans la Mitidja (Algérie).** —*Rev. Path. vég.* **29** fasc. 3 pp. 119–136, 3 graphs, 11 refs. Paris, 1950.

Investigations on the bionomics of *Capnodis tenebrionis* (L.) [*cf. R.A.E.*, A **31** 183; **34** 369; **39** 230, etc.] were carried out at El-Affroun, Algeria, in 1949. Observations on heavily infested plum trees that were uprooted and caged showed that adults emerged from 8th July until 24th August, mainly between 22nd July and 8th August. There was only about 10 per cent. mortality before hibernation, and activity was resumed at the beginning of April. Most of the overwintered adults were killed by the sirocco in July or September, and it appears unlikely that any survive a second winter. Newly emerged individuals did not become sexually mature until they had fed, and injury by the adults was greatest in August, declining at the approach of winter and increasing in spring as the days got warmer. The adults did not move far from the place of emergence, and eggs were laid on the collar of the tree or in the soil within about a yard of it. About half the females that emerged in 1949 laid eggs before hibernation, and all did so after it, beginning in late May and continuing until a few days before death. Oviposition took place only in daylight at temperatures between 26 and 40°C. [78·8 and 104°F.]. The larvae hatched in about 11–15 days in summer, but after longer periods at the beginning

and end of the season, and entered the soil almost immediately. Tests with sections of branches of various fruit trees showed that they did not move far horizontally, but penetrated to depths of at least 8 ins., though most roots were entered in the upper 6 ins. of the soil. In the roots, the larvae developed rapidly at first, the first three instars lasting about ten days each in August and September, but did not pupate until the following June–August. Pupation took place in the roots or root collar, usually just below the soil surface, and the prepupal and pupal stages probably lasted about 40 days.

Guessous (A.) [formerly Fieuzet (L.)]. **Recherches sur la ponte du capnode noir des arbres fruitiers** (*Capnodis tenebrionis* **L.**).—*Rev. Path. vég.* **29** fasc. 3 pp. 137–151, 1 fig., 4 refs. Paris, 1950.

The following is based on the author's summary. Investigations in Morocco showed that females of *Capnodis tenebrionis* (L.) deposited about a tenth of their eggs at the foot of the fruit tree in which they had developed and the remainder, generally singly, just below the surface of the surrounding soil, usually less than 4–6 ins. away, but sometimes up to 16 ins. from the tree [*cf.* preceding abstract, etc.]. Stones on the soil surface did not attract ovipositing females. Oviposition was heavy, particularly in July and August, and the females apparently laid at least 300 eggs each. They deposited a few eggs before hibernating, and the preoviposition period lasted about three weeks. The egg stage averaged ten days in July and August. The process of oviposition and the ovipositor are described.

Gouguenheim (M. R.), Perrier (D.) & Rungs (C.). **Remarques sur les larves de deux Buprestides du système radiculaire des Rosacées fruitières** (*Capnodis tenebrionis* **L. et** *Aurigena unicolor* **Ol.**).—*Rev. Path. vég.* **29** fasc. 3 pp. 152–157, 1 fig., 14 refs. Paris, 1950.

An adult reared from larvae similar to those of *Capnodis tenebrionis* (L.) found attacking the roots of apricot near Marrakesh, Morocco, in 1946 was identified as *Perotis* (*Aurigena*) *unicolor* (Ol.) var. *igniventris* Escal., and this Buprestid was also found attacking the roots of almond at Marrakesh and of apple at Sefrou in 1949. When larvae of the typical *P. unicolor* from stumps of *Thymelaca lythroides* in the forest of Mamora, *P. u. igniventris* from the roots of apricot and almond at Marrakesh and *C. tenebrionis* from various districts in Morocco were compared, no difference was observed between the two varieties of *P. unicolor*, but characters were found differentiating *P. unicolor* and *C. tenebrionis*. These are described and illustrated.

Papers noticed by Title only.

Esquivel (L.). **Primer suplemento a la lista de Himenópteros parásitos y predatores de los insectos de la República Argentina.** [A first Supplement to the List of Hymenopterous Parasites and Predators of Insects in the Argentine Republic.]—*Rev. Soc. ent. argent.* **14** no. 5 pp. 270–296, 61 refs. Buenos Aires, 1950. [*Cf. R.A.E.*, A **30** 215.]

Séguy (E.). **Un nouveau Calliphoride** [*Sarcophaga mezzadrii*, sp. n.] **parasite du criquet migrateur** [*Locusta migratoria migratorioides* (R. & F.) in French Sudan].—*Rev. franç. Ent.* **18** fasc. 2 pp. 119–121, 1 fig. Paris, 1951.

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NOTICES

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